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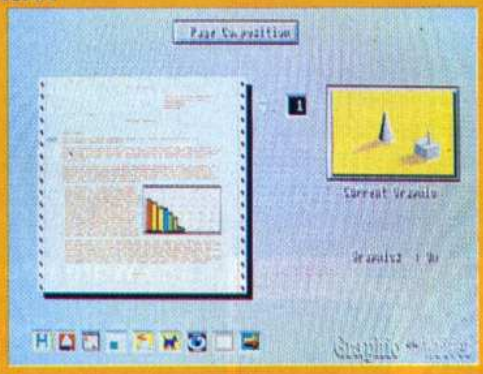

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A&B COMPUTING

Volume Six Number One January 1989

Editor: Mark Webb
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A&B Computing is published monthly on the first Friday of the month preceding cover date. Editorial and advertising enquiries to A&B Computing, Number One Golden Square, London W1R 3AB. Telephone: 01 437 0626.
Software purchases on 0442 41221. Send to Reader Services, 9 Hall Road, Maylands Wood Estate, Hemel Hempstead, Herts, HP2 7BH.
UK newstrade distribution by SM Distribution Ltd, 6 Leigham Court Road, Streatham, London SW16 2PG. Telephone: 01 677 8111.
Overseas sales and non-newstrade sales by Magazine Sales Department, Number One Golden Square, London W1R 3AB. Tel: 01 437 0626.
Subscription department (and back issues): Infonet Ltd, 5 River Park Estate, Berkhamsted, Herts HP4 1HL. Tel: 04427 76661-4.
Airmail rates provided on request.

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Typeset by Island Graphics Co. Ltd.
Cover design and design by the ASP Design Studio.
Printed by Chase Web, Estover Industrial Estate, Estover, Plymouth, Devon PL6 7PY.
ISSN 0264-4584

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REGULARS

Down Under 12
Our Australian correspondent writes.

6502 Go! 17
Programming expert Robin Burton takes another in-depth look at the heart of the matter.

The Arcade 21
Games galore – More games than ever before!

The Ware House 26

Fixing The Figures 29
Gambling – and how to get the upper hand.

Communicate 65
David Janda, and all that's new with comms.

REVIEWS

Acorn News 9

Bruce! 11
Rotterdam Show Report.

Treasure Hunt 84
Education at large, and not a sign of Anneka Rice!

DTP – FOR REAL

Comment 14
Clive Grace reports on the recent DTP Show.

DTP – The Next Generation 38
Bruce Smith previews the latest DTP package from Acorn.

Faxsheets 41
A DTP glossary for you to carry around.

Newsday 61
When the editor's away, the children will play!

ARCHIMEDES COMPUTING

Programming the ARM 43
Paul Fellows delves deep into the Archie.

Gammaplot 46
Jonathan Evans presides over Minerva's latest presentation software.

Archimedes Software 50
All the best Arc software for *you* to use!

Archimedes LOGO .. 51
The latest and most powerful version of LOGO reviewed here.

Archimedes Report 54
Image processing progress by Arc expert Gordon Taylor.

Arc Stars 62
Want some games for the Arc? Darrin Williamson takes a look.

FEATURES

Music Competition 60
Win a £1200 Archimedes System.

Micronet Offer 83
Take advantage of our Micronet offer – Only in A&B!

Proramming Plus 88
BBC programs to type in – first in a series.

Merry Christmas and a Happy New Year readers from all at A&B.

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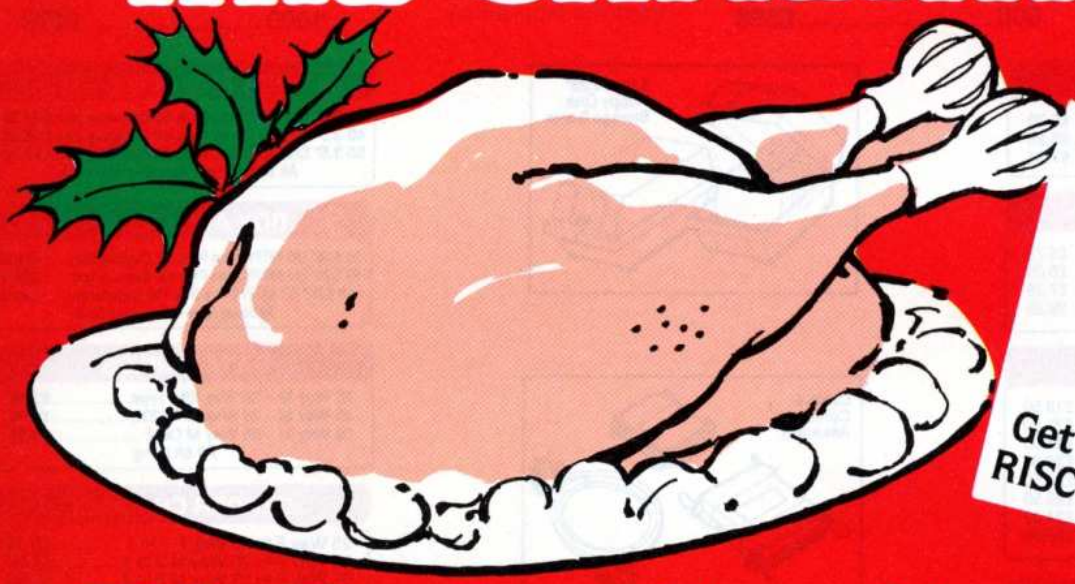

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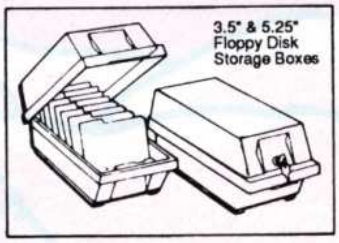

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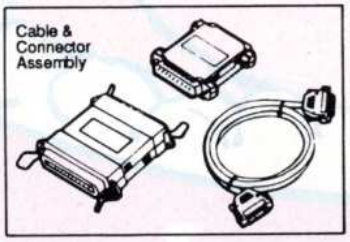

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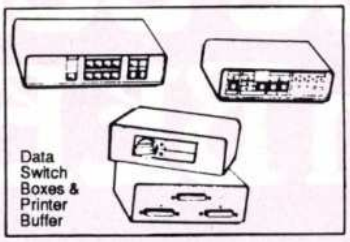

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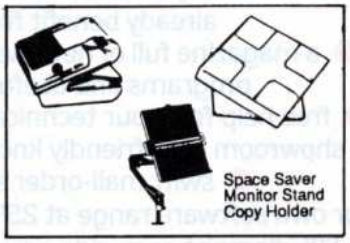

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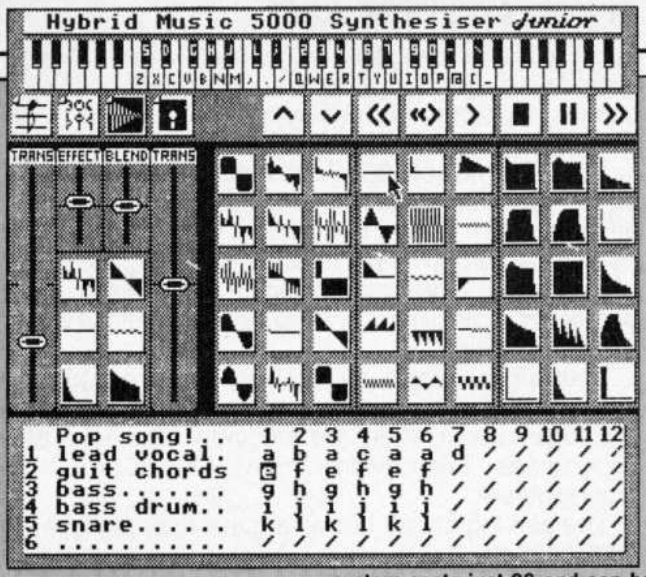


Junior Choice

Hybrid Technology have just launched a more economical music composition system based around Music 5000 technology.

The *Music 5000 synthesiser Junior* is a cut down version of its more expensive counterpart, but will retain the music editor, mixing desk, sound designer and QWERTY music entry. The system costs just 99 and can be upgraded to full 5000 spec with the additional purchase of the AMPLE ROM. This gives you probably the most cost-effective entry into the world of professional computer music.

● For more information Contact Hybrid Technology Unit 3 Robert Davies Court, Nuffield Road, Cambridge CB4 1TP ☎ 0223 316910

Arc Pipedream speller

Robert MacMillan of Colton Software tells us that Colton have taken back the marketing rights to View Professional. Colton's View Professional will feature an improved sort and a BBC link program.

Archimedes Pipedream is to have a "bolt on" spelling checker which will install itself from disc. The dictionary will contain between 80 and 100,000 words and it will check at 40,000 words a minute. It can check as you type and there will also be an anagram and crossword solver and browse feature.

Arc Strip

Ian Copestake is renowned for his software design but may gain new fame with his *Arckey* Archimedes key strip holder. IBMers have 'em so why not Archiephiles too?

Arckey is brilliantly simple, consisting of a ringbound card cover with 15 polyester strips inside, each with a self-adhesive panel. Just peel of the paper covering and stick on your keystrip (BASIC editor, 1st Word Plus etc). The appropriate strip can then be selected from the collection and inserted into the plastic keystrip window at the back of the keyboard. Price £3.50. ☎ 051 648 6287 for details.

Arckey

The Archimedes Key Strip Holder

Design Copyright © Ian Copestake Software 1988

Acorn UNIX workstation to feature X.desktop

Cambridge based IXI's X.desktop user interface has been chosen to "front" the Acorn UNIX workstation which will be released in January 1989.

X.desktop and Uniplex Business Software will be bundled with the RISC based computer system.

X.desktop sits the classic WIMP environment on top of the UNIX operating system. IXI have recently licensed X.desktop to PC manufacturers in the USA, among others. It is the design of ex-Torch development director Ray Anderson. Torch introduced the OpenTop graphical interface.

The bundled Uniplex II Plus combines the classic range of wordprocessor, spreadsheet, relational database and financial modeller. Users can take advantage of electronic mail, time management software, a report writer and a wide range of charts, graphs and drawing capabilities.

The Acorn UNIX workstation will offer multitasking. Multitasking involves the computer carrying out more than one operation at once eg recalculating a large spreadsheet while sending a text file to a printer whilst the user scans a database.

UNIX is also known for being *multiuser*. Multiuser operations require fast serial communications and it is unclear whether Acorn's promise of "group working" capabilities means multiuser – where terminals use the central processor – or networking. One clue comes from S.J.Research's announcement of an *application server* which provides an upgrade path for the BBC Econet user to MSDOS and UNIX. BBC Micros attach to the system as terminals using the network as a high speed serial link.

Certainties abound however, that a large capacity hard disc will be required, that a high RAM count is a prospect and that not only the technology, but also the price, will break new ground.

Design Prize winner uses Master 128

Daniel Dalton from Hook in Hampshire is one of the five winners in the 14-16 year old age group of the 1988 Schools Design Prize competition. He takes away £200 and a certificate plus £200 for his school, Robert Mays School in Odiham.

Current school workshop technology makes drilling large numbers of printed circuit boards very time-consuming, so Daniel decided to design a more efficient machine as part of two of his GCSE courses, CDT Design and Realisation and CDT Technology.

The drill interfaces with a BBC Master running a BASIC control program. Machine code is used where BASIC proved too slow. Daniel used 12 volt DC motors to power the machine. To avoid a gradual build up of error, the terminals of the motors are earthed when switched off. This enable sthe machine to be accurate to 1/100 of an inch. The computer provides visual confirmation of the status of the mchince to the user.

The prototype cost about £20 to build and Daniel has estimated that it would cost £200 to manufacture, although there are modifications he would like to make, such as adding a stabilising wheel to prevent the weight of the drill head resting on the screw threads. There is no comparable machine available at a price schools can easily afford. We'll ask the question on behalf of Lord Young, who awarded the prizes, "are there any enterprising entrepreneurs out there willing to take it on?"

Software Strategy

In the October educational supplement we missed out the *language* section of the software strategy chart. Apologies; it is published here in full for you to add to your list.

Level One	Level Two	Level Three
LANGUAGE		
Visual Discrimination		
Blob (1)		
Window (2)		
Jigsaw (3)	Sliding Block (3)	
Word Processing/Desk-Top Publishing		
Prompt/Writer (2)	Pendown ->(4)	Edword (5)
Folio ->(6)		Interword (7)
Fairy Tales (et al) ->(8)		Typesetter (9)
Front Page Extra ->(10)		
	Desk Top Stories (Archimedes) (8)	
Teletext Emulators		
Create (Box of Treasures) (11)		
News Bulletin (10)	Telebook ->(11)	
		Mikefax (12)
Creative Language		
Podd (3)	Story Starts (9)	Mystery Island (43)
Facemaker (3)	Chatterbox (3)	Mr Maqus is Waiting for You (16)
The Circus (9)		
The Farm (9)		
Moving In (2)		
All About Me (13)		
Cartoon (14)		
Where's Blob? (1)		
Wordweb (3)		
Word Games/Phonics		
Word Builder II (9)	Reading Packs 1-4 (15)	
	Wordspinner (16)	
	Crossword (15)	
	Wordsearch (14)	
	Crossword Callup (13)	
		Crossword (17)
Creative Language thro' Adventures		
Albert's House (8)	Box of Treasures (11)	
Granny's Garden (11)	Geordie Racer (18)	
Dragon World (11)	Stig of the Dump (8)	
Pip Goes to the Moon	The Worst Witch (8)	Flowers of Crystal (11)
Pip's Island Adventures (13)		
The Teacher's Cupboard (9)	Merlin's Castle (3)	Dinosaur Discovery (11)
Zoopac (11)		
Yellow Brick Road (13)		Fleet Street
The Lost Frog (3)		Phantom (9)
		Worlds without Words (11)
Adventure Generators		
Sly Fox (19)	The Last Adventure (25)	
Touch Explorer (41)	Make an Adventure (14)	Tombs of Arkenstone (20)
Touch Expl.Plus (2)	Mallory (10)	
Fairy Lands (et al)(8)	Adventure Writer (4)	
Language thro' Simulations		
		Police Language in Evidence (21)
Text Decoders		
Infant Trav	Trav ->(14)	Enigma (29)
Muddles ->(22)	Crack It ->(3)	
	Letra (23)	
Text Generators		
	Tins	
	Storyline	
	Tracks (14)	

Flying start for S.I.D.

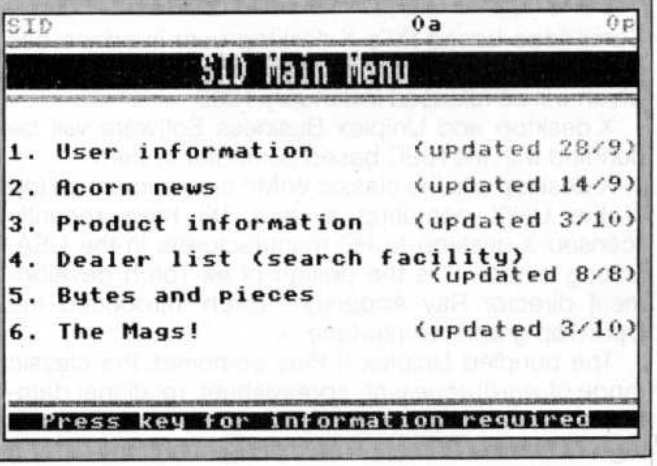
Acorn's own online system is rapidly taking shape with a number of columns beginning to appear (including comms of course) and the seeds of a public domain library of software for B, Master and Archimedes.

In the first half of 1987 Acorn initiated the idea of an online database to support its dealers and customers. S.I.D. has now begun to fulfill that role and there is a good balance between 8 bit and 16 bit machines.

Acorn are making the system available to third parties (at a price) to develop specialist closed user groups (CUGs).

Software houses such as DABs Press are placing demos on S.I.D. and Clares are going to run a graphics column. There are a number of reviews plus Archimedes telesoftware from A&B Computing, among others.

You can log onto S.I.D. as a guest user anytime. ☎ 0223 243642.



All Agog

Ed Leonardo Jewasinski has sent us a copy of the literary magazine AGOG, produced with Master 128, View and a Sanyo PR3000. Ed – we are not sure whether this is his name or his title, or both – resisted the temptations of PC DTP technology and his cry throughout production was "back to basics". He feels the BBC is easy to use and reliable. The back to basics approach certainly works with this entertaining little mag, full of thought-provoking words and pictures for £1.00. Also on the way may be AGOG A GOGO, a mag on disk.

Text tools

Since we are in DTP mode this month here are a few handy addons to help layout text.

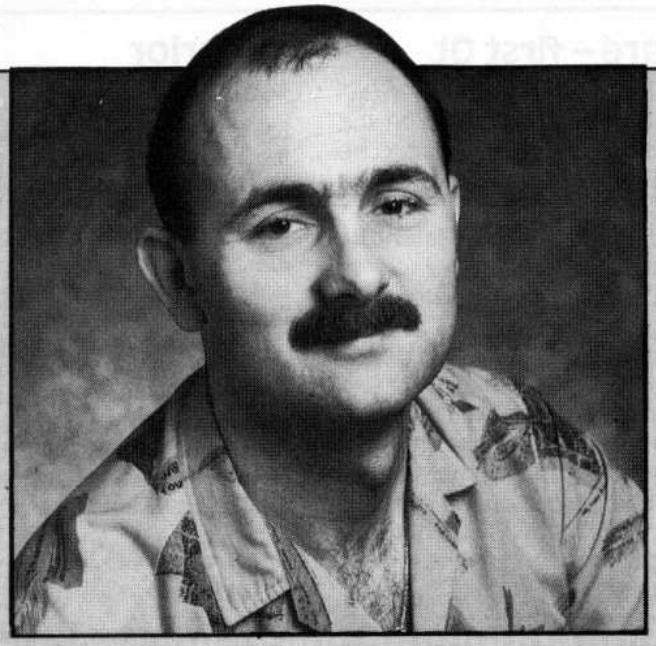
Kompukalk is a transparent plastic ruler which can be used to plan a blank sheet of paper or measure pre-printed material. In the print trade it's known as a pitch/line scale. Ring Kador on ☎ 0443 740281 for details.

TempMate is a clear A4 plastic sheet which is printed with a grid of lines and indicators. It is designed to help plan the precise positions for setting tabulation, margins etc in word-processed documents. It was originally developed as a teaching aid for wordprocessing students by Brian Thurston Worts. Price £4.30.

Page Boy is a clear plastic ruler which measures text instead of inches. Text lines are 10, 12, 15 and 17 characters per inch. Price £2.13. Details for both from Thurston Techniques on ☎ 0395 277496.

DISK USER

It has been announced that the December issue of Disk User for the BBC Micro, the disk-based computer magazine, will be the last. If you are interested in learning about a brand new disk-based magazine for the BBC Micro, Model B, Master 128 and Master Compact then you can write for full details to: **Disk User, Number 1 Golden Square, London, W1R 3AB.**



BRUCE

"The level of understanding of the Archimedes by the Dutch users was beyond anything I have come across in my travels..."

The Big Ben Show in Holland proved to many that the computer show is alive and kicking – Perhaps something like this could be set up in England?

The new year is fast approaching and one of the first dates I always pencil in on my new diary is the second weekend in October and an enthusiastic trip to the Netherlands. Contrary to popular belief it isn't to brush up on my Double Dutch but to attend the Big Ben Club Show. This Dutch user group has been going for some six years now with a membership that hovers around the 3000 mark and the majority of whom make the annual trip to the one day extravaganza which was recently held in the heart of Rotterdam.

The theme of this years show was the Archimedes and I for one was quite amazed at the following it has across the North Sea and the number of hacks who actually own them. In fact the micro is rapidly establishing itself as a cult machine and no where more so than on the southern side of the Ardennes in Germany. And it is this fact that which is giving Acorn a headache – but one I'm sure they won't be in any hurry trying to cure. Simply, Acorn cannot sell the Archimedes directly to Germany as it has not passed their strict DIN standards (their equivalent of our BS). So Dutch dealers are busily snapping up the Archies and pushing them across the border.

The Editor of one excellent German computer hobbyist magazine, *Happy Computer*, was just one of tens of German users making the trip to Rotterdam to purchase his full share of Arc software most of which will be filling the pages of magazines review-wise over the coming months.

The organisers of the Show (all Big Ben members and totally un-paid) could teach the AU and Micro User Show organisers a thing or two as well, as they are incredibly well run. Acorn, who were represented at the show by their new International Sales Manager David Tee, could also take a few pointers as the show clearly demonstrates that lectures and seminars can live hand in hand with dealers wheeling and dealing – a point made in this column in the October issue of A&B.

People thronged around the stands for much of the day disappearing off to lectures and demonstrations at the appropriate times, although many of them were on a rolling basis, ie, continually repeating during the day. The level of understanding of the Archimedes by the Dutch user was also beyond anything I have come across in my travels around the UK, and I was continually having to smile and nod knowingly as I listened to detailed explanations of its inner workings totally beyond my comprehension.

This year's Big Ben Show also had the best participation ever from England, including Minerva, EMR, Oak Computers, DABS Press, Beebug, Acorn User and of course A&B – which shows just how seriously the date is being taken.

Of course while business was booming, the social events being arranged were not to be missed and I'm quite sure that all the ensuing gossip will be heavily featured on the Back Page!

While on the subject of the Archimedes abroad it seems that the machine is now making in-roads into the Big Apple. Acorn tried to crack the American market a number of years ago and despite going £18 million over their £2 million budget failed drastically. Now it seems even IBM are taking the machine to heart, having just ordered a number of Archie publications from Dabs for their Rochester based plant in Minnesota.

Of course the BBC B and Master are well known in all sorts of circles. It seems that would-be Labour Party leader Tony Benn has six of each being utilised by two full time secretaries to write his memoirs – two on each hand no doubt. Interestingly enough maybe it was Kinnock, another Beeb user who gave him the idea in the first place. The whole 250,000 word project is being undertaken with Wordwise Plus. Trouble is none of them can get to grips with it and they have now resorted to a copy of my Collins book 'Wordwise Plus A User's Guide'. They must be desperate!

Write to Bruce! Send us a letter to Bruce's newsdesk c/o A&B Computing, No 1 Golden Square, London, W1R 3AB

ESM literature

A colourful catalogue update from ESM hit the desk this month. All software is still available on free trial to teachers so there's no excuse not to have a look. Anita Straker puts her name to some new adventures, there's Screenprint – in colour – Podd and Numbercopter for Concept Keyboard and step by step guides from Hampshire TVEI for the View family.

Details on ☎ 0223 65445

Nebbie award

The Oxford University Press/BBC Enterprises interactive video co-production *Volcanoes* has won the 1988 Nebraska Videodisc Awards' *Best Data Bank Achievement* prize.

As reported earlier this year, BBC Enterprises are marketing the Domesday System compatible disc. Producer Andy Finney, who received the award, paid tribute to author Rex Beddis who died shortly before the project was published in April 1988.

A&B 1988 programs

If you've liked the look of the program listings which we've published in A&B during 1988 but haven't had the time to type them in then why not get the programs on disc? See Programming Plus for details of our A&B '88 compilation. A 3.5" version for Master Compact is also available. And don't worry if you missed the relevant issue, there's a laser printed manual with all the instructions included too.

Sharemaster on ADFS

Synergy Software tell us that they are currently working on a version of their share portfolio manager for ADFS users. Find out more on 0582 424282.

Games?

Return of the Jedi, Live and Let Die, APB car game, Vindicators, Xybots – all new games from Domark? Or are they going to be on the BBC Micro in 1989?

Not much movement from Bugbyte in 1988 but Grandslam, having celebrated their first anniversary, may have some Monkey Nuts ready for Beeb owners with £1.99 to spend.

Meanwhile Tynesofts next "games" is going to be Circus Games with lion taming and trapeze and all that fun stuff.

Keydefine software – first QL Port?

A software package just arrived in the office on the day the Archimedes news section was to go off to be typeset, so details of *Keydefine* are patchy at the moment.

The software package, produced by **Psientific Software**, is a development of the "popular" QL package (let's hope it isn't the kiss of death for it then!).

BASICally keydefine allows the user to define frequently used text strings and place them in a text file, any section can be later accessed with the mouse to send the chosen string to the current program.

The user defined strings work in the same manner as normal strings which can be placed on the Archie's function keys with the advantage that you can have an unlimited number of defined strings, and as the strings are visible before selection, you don't have to remember which key contains which string. The routine is designed to work with, and supplement, other packages such as the *BASIC Editor* and *1st Word Plus* or *Arcwriter*.

Keydefine is, at the moment, only available by mail order and is priced at 14.95 including a small 4 page booklet.

● Contact: Psientific Software, 37 Cottesmore Road, Hessle, North Humberside, HU13 9JQ. ☎ (0482) 649187.

EEK a Lucky Mouse

If you intend buying an AMX mouse in the near future, you could end up with more than you bargained for.

Advanced Memory Systems have organised a terrific scam for the 100,000 th purchaser of the aforementioned rodent.

If it happens to be you, then fanfares will sound and your freindly neighborhood computer dealer will come forth with a scrummy Fortnum and Mason hamper which isn't a particulally good mouse mat but it should cure the rumbletums on Christmas morning!

Sales had just passed the 90,000 mark back in September and MD *Nick Pearson* estimates that it should take about 2-3 months to reach that magic figure.

Good Luck Gang!

● Contact Advanced Memory Systems Ltd, 166-170 Wilderspool Causeway, Warrington WA4 6QA ☎ 0925 58039

Minerva movements

As reported elsewhere in this issue Minerva Systems are one of the busiest BBC companies at the moment. A recent trip to Australia and New Zealand to demonstrate Arc and BBC software included visits to user groups, educational authorities and dealers.

Perhaps the most exciting development is RISCOS based software. Although *Home Accounts* might sound a disappointing start, what about multiple bank accounts, credit cards or building societies, automatic posting of standing orders and transfers of funds between accounts. There's budgeting, cashflow forecasting, warning of bank charges or overdraft situations. It's going to need multitasking!

The Minerva range now extends to 24 Arc titles and 15 BBC. New product news includes a fully relational Reporter module for System DeltaPlus.

And in 1989 look out for Minerva's art package. It looks as though there's going to be a real head to head between Clare's Artisan Professional and Minerva's Atelier. What does it all mean? ☎ 0392 410137 for details.

Superior with bite

Superior Software has acquired the Alligata label, remembered fondly for its Image II disc utility as well as a series of games such as Defender clone *Guardian*, *Bug Blaster* and the excellent *Olympic Decathlon*. It seems likely that Superior, having sold the rights to their back catalogue on budget to CDS' Blue Ribbon label, will use Alligata to market Repton and Co for computers other than the BBC. *By Fare Means or Foul* will be the first to get the Alligata treatment.

Thirty-two today

Ground Control have announced an upgraded UVIPROM EPROM blower for the BBC Micro. UVIPROM 16/32 is reasonably (our judgement) priced at £30.00. It programs 2764, 27128 and 27256 EPROMs, including CMOS and "A" versions. The UVP 1.1 software includes *READ, *COMP, *VIEW and *TEST.

Details on ☎ 0702 230324

Archimedes Computers Networked in Italy

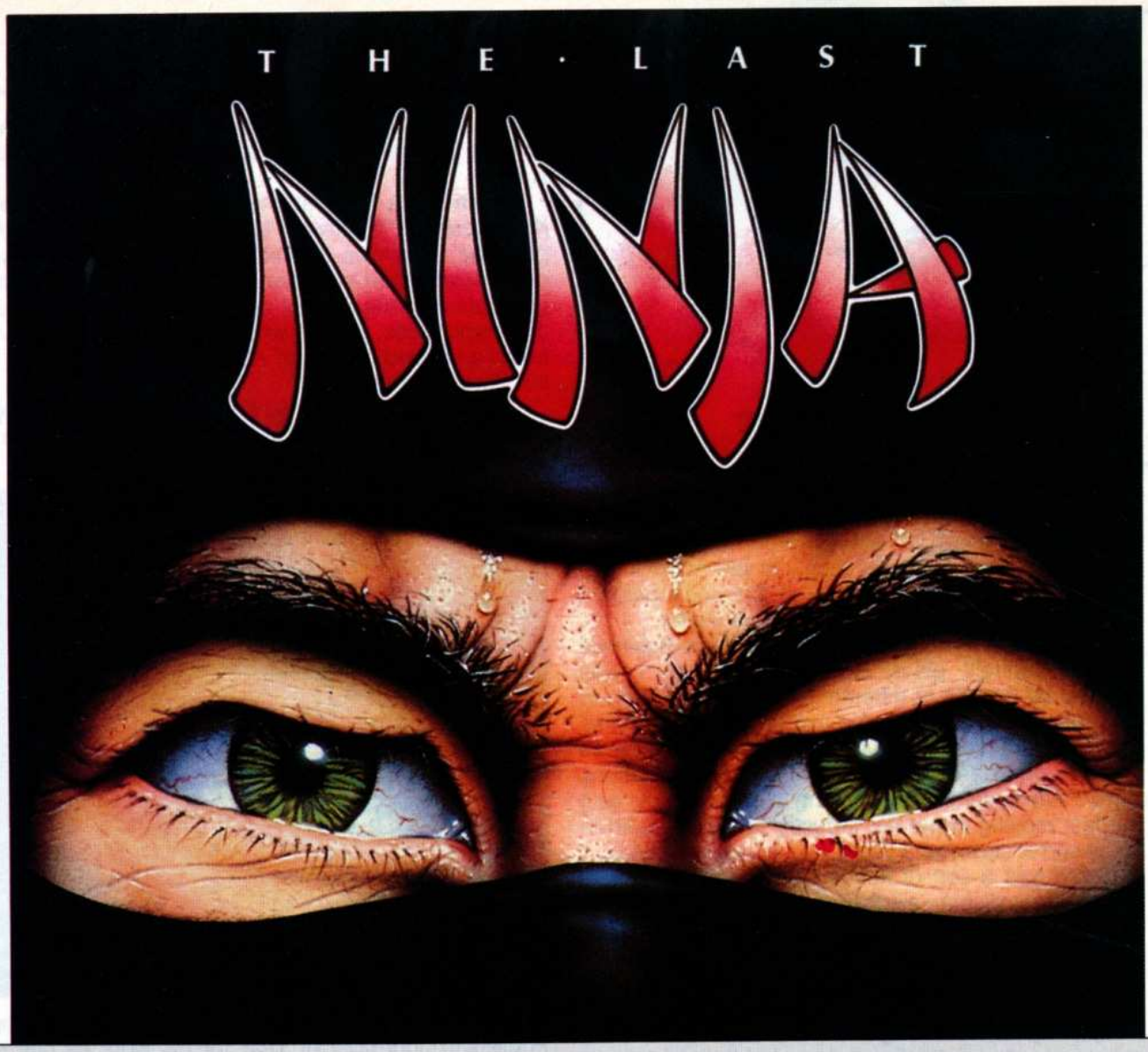
In accordance with Italy's national plan to introduce micros and computer studies into all secondary schools, the *Instituto Technico Statale Commerciale "Vincenzo Comi"* school for accountants have installed over 20,000 worth of Archimedes equipment with Econet and 20 Megabyte filestore. The networked Archimedes systems will be used to teach programming and networking techniques to students aged 14-18 years old.

This is quite a move for a country that has MS-DOS as a compulsory standard in all Italian schools, and teachers – once aware of the excellent emulation capabilities of the Archimedes – were more than happy to use Acorn's "golden boy" computer.

Half price lock

Computerlock, the company, has halved the price of Computerlock, the product, to £12.50. Computerlock is a ROM based protection system requiring a password to be entered before the computer can be used. Details on ☎ 0532 693393.

THE LAST NINJA



LEVEL 1

LEVEL 2

LEVEL 5

LEVEL 6

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(The screen pictures show the BBC Micro version of the game.)

THE LAST NINJA, one of the greatest No. 1 hits on the Commodore computer, is now available for the BBC Micro/Master and Acorn Electron computers, under licence from System 3/Activision (UK) Ltd.

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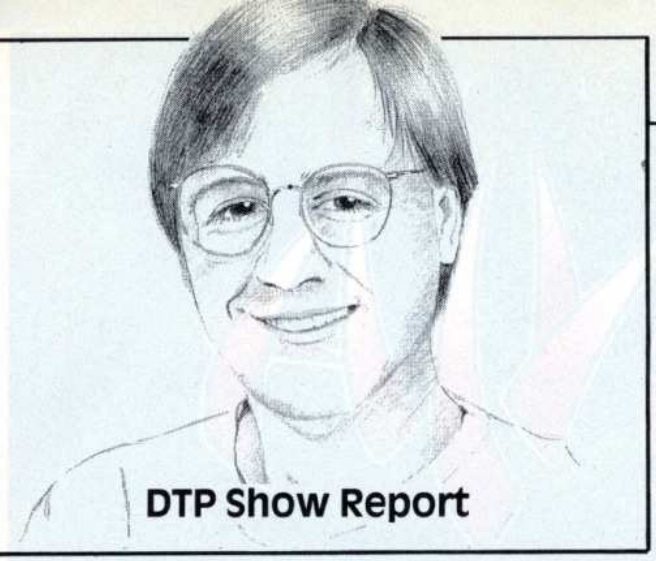


DTP Show Report

Last month saw the second *Desktop Publishing Show* (held at The Business Design Centre in Islington), a difficult place to get to, but well worth the hike down old territory. I went along primarily to see Acorn's DTP software in action for the first time, but once inside, I saw a great deal more than I had bargained for.

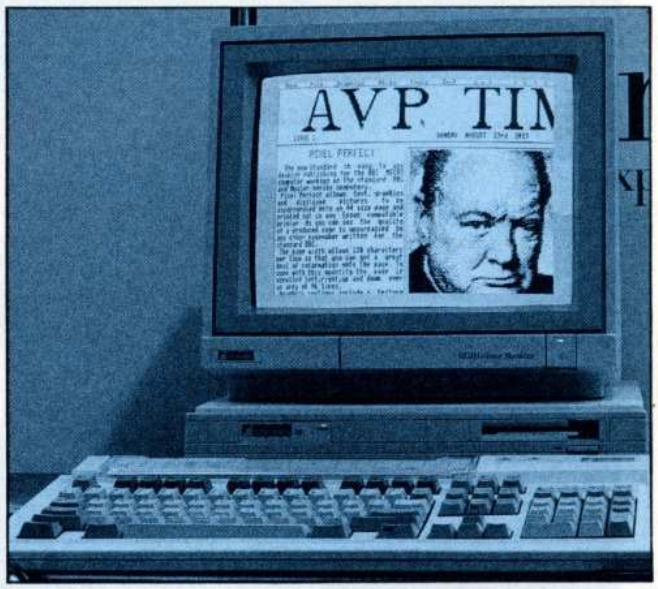
Once inside the studied elegance of the Business Design Centre's glass exhibition building, I was greeted by dozens of different machines linked up to laser printers and typesetting machines, I saw Apples and PCs in action doing *exactly* the same things as they had done last year – but this time the applications were a little faster or were running in colour, it was as if the fast moving computer industry had been held in some sort of stasis for a year.

There was a sort of hushed reverence as people walked from display to display – there were few dot matrix printers (only Laser printers and a Linotron 202-P typesetting printer) so upon walking into the main hall, we were immediately greeted by soft the lilting music of Ravel and not (I was pleased to note) by noisy people or clanking computers, just a low murmur or people quietly discussing what they had come to see – DTP.

Adobe – the creators of the *Postcript* page description language – were about the most popular people exhibiting on the upper plaza, and with the release of *Freehand* software for the Mac, their stand was in stark contrast to the positively weird **Digital Research** stand showing off *GEM Desktop Publisher* (currently being tested on Master 512's) – weird because I couldn't see *what* they were showing on the screens of their PCs, so poorly laid out was their stand.

Acorn were also at the show, displaying their *Archimedes DTP* software based on the *Timeworks III* package. This was the first public showing of their nearly completed software, and like many other Arc products, it made a lot of people stop and ask about the Archimedes, people who would have never have taken a second glance at Acorn's products before – the word is spreading.

I will leave the account of the *Acorn Desktop Publisher* software up to Bruce Smith – his account appears later on in this magazine.



Bruce Smith took away the award for Desktop Publishing Journalist of Year for his work as half of DABS press, utilising DTP technology to create DABS' range of technical books and manuals – many of which are for the Beeb and the Archimedes.

Also on show was the Archimedes version of *Pixel Perfect* AVP's DTP software previously only released for the BBC Master – it was a good deal more down to earth (and justifiably priced as such) than the Acorn DTP software, it was a very basic package – more aimed at schools and colleges, but it was up and running, and gaining a lot of respect from training companies who were looking for this sort of approach to simple layout software.

Acorn are almost on the verge of releasing details about their new UNIX machine to the public, "just leave your card if you want more information" the sign gleefully said, so I put in half a dozen just to be sure I would get the news to you ASAP!

Looking Back

The DTP show didn't really cover the popular 16 bit home computers – **Mirrorsoft** showed off their now ageing ST version of *Fleet Street Editor* (named *Fleet Street Publisher*), but on the whole, companies such as Commodore and Atari have been largely overlooked – they have lost whatever momentum they may have gained.

Speaking to a show organiser, his opinion was that the ST and Amiga home computers really aren't offering anything particularly attractive – "the groundwork has already been done on the 16 bit architectures

of business computers, so professionals aren't interested in toys that mimic the big boys".

This year's DTP show was aimed at PC users and Mac owners, but Acorn put up a good show. A lot of people whom had previously never encountered Acorn's machines before were amazed at the system's speed and colour – something only the Mac II was capable of showing off.

I get the feeling that Acorn view their Desktop Publishing software as merely a start – showing software houses what the Archimedes can do, and trying their best to nurture third party software releases from the likes of Aldus and Adobe – we all wish them well.

"DTP – Merely a Start"

On the subject of laserprinters, the gap between postscript and non-postscript compatible printers seems to be widening inexorably so that we are now seeing very little development at the low end of the market (other than the cheaper printers getting even cheaper to buy). More expensive printers are turning into colour printers (care of Oce). Many of the software houses are concentrating on supporting postscript formats – thus giving a link to the higher resolutions laserprinters and (more importantly), typesetting machines, such as the Blaser and the Linotron 202P.

It was a relaxed show with much to learn about, a great deal to look at, and a professional approach that I could not find fault in. Most of the companies were interested in the user's needs and applications no matter how large or small, and I was especially impressed by the Acorn stand, once again occupying prime territory.

Everybody I managed to speak to felt that 32 bit technology was needed to take DTP into the 1990's. I met a colleague from the printing and allied trades at the show and his feeling matched mine – we both felt that the Archimedes has a place in the next generation of DTP solutions – that Acorn have already made a start in that direction with their version of Timeworks III, and that Acorn are entering a demanding marketplace with machines powerful enough to meet that demand without having to standardize which has always been Acorn's *forte* – we are especially fortunate that the publishing world doesn't really care about what machines they use so long as they do the job properly.

The DTP show was immensely satisfying from the point of view of a journalist looking at how easy his life could be in the near future; it was pleasing to note that publishers and software houses were interested in what Acorn were doing with their Archimedes computers. From a technological point it was satisfying to note that the Commodore Amiga crashed twice throughout a demonstration, and that IBM were not dictating to the marketplace, rather printers and designers were specifying what they would like to see, and then they would see it in operation a year or so later.

A very satisfying show, and one that left me thinking that perhaps the computer industry, for all its foybles, has grown up a little bit by linking to the typesetting and printing industry.

What a nice thought to take home,

Clive D Grace, A&B Computing

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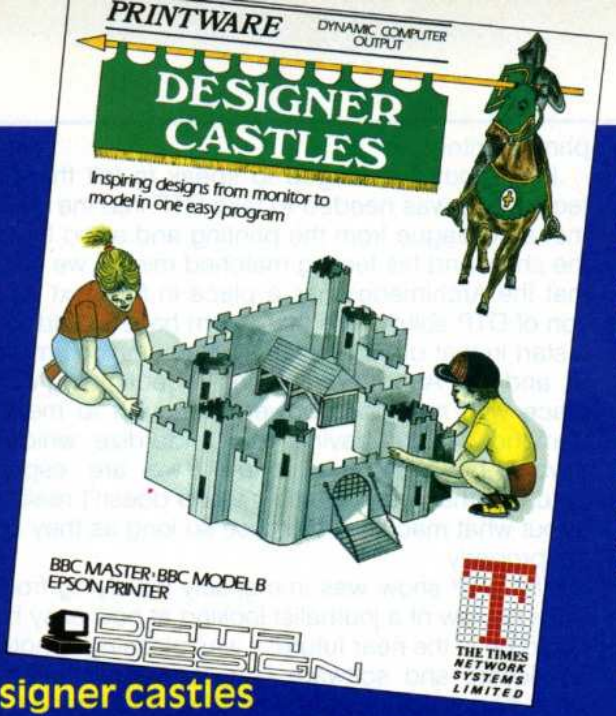


Designer castles

Data Design have launched their Designer Castles pack which was previewed at the A&B/Watford Electronics Open Day at the end of September. By all accounts visitors to the Open Day were very taken with the program.

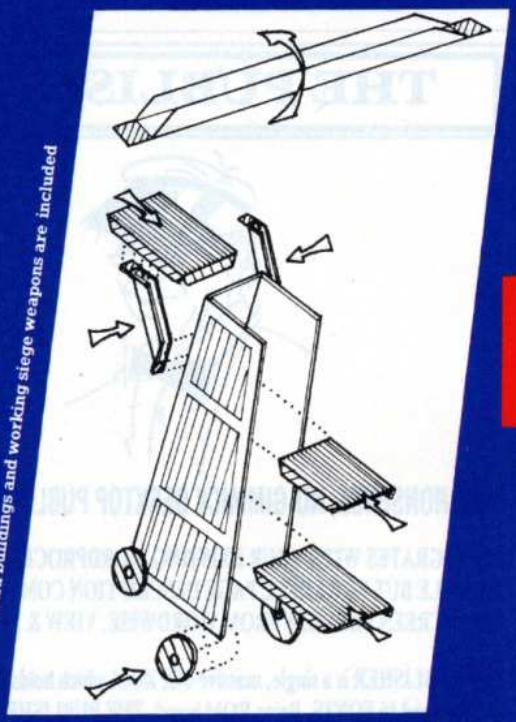
Data Design feel that Designer Castles embodies a new concept in microcomputing, a link between computer design and printer and paper as a modelling medium. This is not a totally new concept. Among others, Gert Van Dijk's Global View program provides a printout for modelling with light card. However Designer Castles takes the idea further than ever before and they've labelled the concept *Printware*.

The designer creates walls "full frontal" and then links them in plan view. Designs of any shape, size or complexity are then printed out on paper ready to be trimmed, folded and assembled into full three dimensional models of the castles. Plans are printed as construction guides and all pieces appear complete with glue tabs and strngtheners to ensure a sturdy and usable model.

Once you've invested in Printware, the same support ROM can be used with additional disc-based packages being developed, such as Medieval Villages. Times Network (TTNS) has a database of castles (type CASTLES) for downloading. Don't miss the April issue of A&B Computing where we will feature the program in our Educational Supplement.

Designer Castles making an early appearance on Des Thomas' education stand at the A&B/Watford Open Day

It's refreshing to find that the BBC still inspires the most original programs around. We have no doubt that Designer Castles will attract any BBC owner with a printer standing idle. The output will keep children entertained for hours. Price £34.50 plus £1.25 postage and packing.

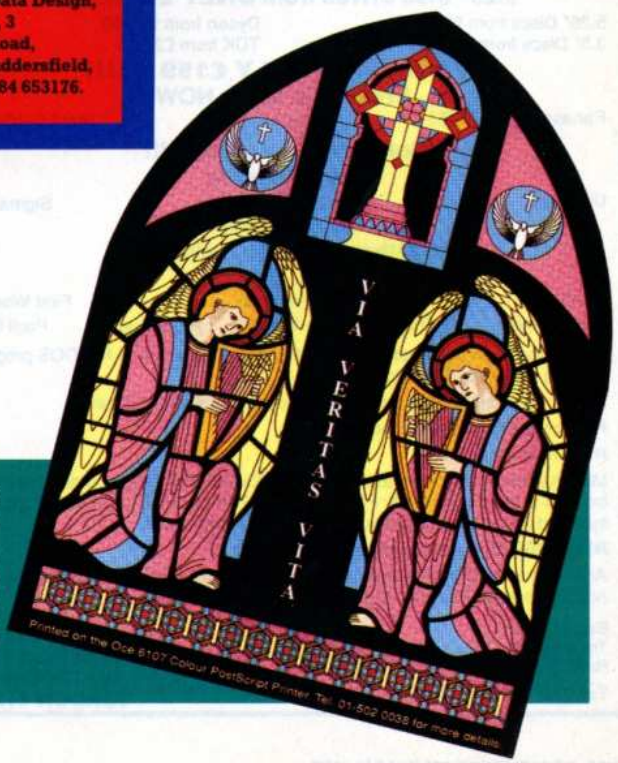


Extra buildings and working siege weapons are included

Details from Data Design, "Gowanbank", 3 Botham Hall Road, Longwood, Huddersfield, HD3 4RJ. ☎ 0484 653176.

Colour PostScript

You don't want to know how many thousand pounds it costs, all you need to know is that it is possible; that colour laser printers like the Oce will be in your high street print shop before too long, if not already; that the Acorn Desktop Publisher will output a PostScript file; that all you have to do is take along your disc!



Robin Burton

We'll be covering two main techniques this month, both concerned with executing machine code routines from BASIC programs

6502

The Calls

To call machine code from BASIC two instructions are provided, 'CALL' and 'USR'. Each offers different facilities so we'll look at them in more detail later, but for now it's enough to say they are both methods of treating a machine code routine as an extension of a BASIC program. As far as the section of machine code itself is concerned, remember that it must end with an 'RTS' so as to return control to the calling program, (assuming that's what's wanted).

There's a good deal of conceptual similarity between machine code and BASIC's procedures and subroutines. In essence the purpose of all of them is to provide a more or less self contained process which is available to the main program from any, or at least several points within it.

In principle there are similarities, but in practice there are major differences. The first concerns why you might use machine code at all, and the obvious answer is code size and speed of execution. Alright, so it's quicker, but just how quick, and does it save much space? Any meaningful answer needs a yardstick, so rather than just quoting figures we'll find out shortly, by running a comparative test.

The second difference concerns data needed in both the main program and the called code. This isn't always required, but when it is the data must be presented in a certain way, because as noted last month, BASIC variables are dynamic and can't be used by name in machine code. This means different methods apply when you want to pass data back and forth. Another facet of this is temporary storage in machine code, for example for counters, flags and so on. In BASIC you simply create variables, but in machine code you must use specific memory addresses.

The final difference concerns where the machine code is loaded. BASIC routines are normally within the main program or, like overlays, direct replacements for a part of it. Loading a BASIC program allocates the memory and automatically takes care of where to store the code. This isn't so for machine code, it isn't part of the BASIC program, so it must be loaded separately, and it needs thought about where to load it.

The next step is to look in more detail at the first two points. The last one depends on what you're doing, how you're doing it and the machine configuration. In other words that one's your problem.

Execution Speed

It's difficult to compare execution speeds directly, because machine code is byte or bit based, and BASIC isn't, but if you don't have a feel for the real difference between the two, or you're unconvinced that it's worthwhile, try these two short routines.

They're not clever, which for comparison is ideal. They both move 256 bytes to another location 256 times, the equivalent of moving 65,536 bytes. Notice that to be generous to BASIC the example uses the fastest loop, FOR...NEXT, a comma in line 50 saves a second NEXT statement and integer variables are used. The machine code version was written with no optimisation, the method is simply the most obvious. Here's the first, in BASIC.

```
10 TIME = 0
20 FOR I% = 0 TO 255
30 FOR B% = 0 TO 255
40 B%?&4000 = B%?&5000
50 NEXT,
60 PRINT "Finished in ";TIME/100;" secs."
```

Enter and run it, noting the time. Just so you don't think there's anything wrong I'll give you a clue. You might just have enough time to make a cup of coffee before the run finishes if you're quick. Now try this version, which does exactly the same, but in machine code.

```
10 from = &70
20 to = &72
30 ?from = 0:?(from+1) = &50
50 ?to = 0:?(to+1) = &40
70 P% = &3000
80 [
90 OPT 3
100 LDX #0
110 LDY #0
120 .move LDA (from),Y
130 STA (to),Y
140 INY
150 BNE move
160 DEX
170 BNE move
180 RTS
190 ]
200 TIME=0
210 CALL &3000
220 PRINT "Finished in ";TIME/100;" secs."
```

I won't encourage cheating, so if you want to know how fast these two run you must key them in and try them. I will say that if you've never tried a direct comparison like this you might be surprised, but you won't be disappointed. By the way, did you notice the single pass assembly? If not, pay more attention.

Of course it's no surprise that BASIC is slower and larger, but the surprise may be how much. It's interesting to note that if you fully optimise the BASIC version, putting it all on one line and omit the time statements and all the spaces you'll shave about three seconds off the run time and it still occupies 46 bytes, while the machine code by comparison occupies only 15.

Remember when you consider machine code instead of BASIC though, that some operations don't depend on code for their

speed. If a routine reads or writes disc, serial port or printer data, for example, the peripheral probably will be the limiting factor. In these cases BASIC is usually quick enough, so machine code may save memory, but not time.

Passing Variables

You'll notice that I used 'CALL' in line 210, but it could just as well have been 'USR'. Both must be accompanied by the address of the called code, but 'CALL' can also take parameters, though none were needed in our example.

A convenience provided by both of these statements is that if single byte parameters are required, an automatic facility is available. On entry to any routine the 6502's registers, A, X, Y (and C, the carry flag in the processor's status register) are set to initial values according to the contents of BASIC's integer variables, A%, X%, Y%, (and C%) respectively. Obviously the processor registers are a single byte, while the integer variables aren't, so remember that high order truncation occurs for values greater than 255.

For example, if A% contains decimal 65 (&41) when the 'CALL' or 'USR' statement is issued, register A in the 6502 will be set to &41. If the value in A% was 321 (&141), the value passed would be the least significant byte, again &41, equal to "A% MOD 256". X%, Y% and their equivalent registers operate similarly. This means that up to three single bytes can be passed across very easily, but remember to store the A,X and Y register values somewhere before you change them.

C% is different. Because the carry flag is a single bit in register P, only the least significant bit of C% is transferred. This is equivalent to "C% MOD 2". This is more limited, but it can nevertheless be used to transfer conditions. You could for example arrive at a 'Yes/No' situation in your BASIC program, and if the condition was properly set in C% it could then control the action in the called code too.

As an example, suppose we wanted to store the values held in A%, X% and Y% in memory at the start of our machine code routine and then conditionally execute one of two optional routines, decided by the contents of C%. Omitting the assembler directives for brevity, here's the outline of such a routine.

```
100 .start
110 STA &70
120 STX &71
130 STY &72
140 BCS routine2
150 .routine1
160 routine 1 code here
170 .....
400 RTS
410 .routine 2
420 routine 2 code here
430 .....
650 RTS
```

In this case the values in A, X and Y are stored at &70 to &72 before anything else happens, but this is optional, we could have tested the carry flag, as in line 140, immediately. Of course if you have instructions prior to the carry flag test make sure that they don't affect its setting, or alternatively store the value of register P first. You will no doubt have realised that you could also use BASIC's indirection to store these values before the machine code was called, but that would be slower.

The Carry Flag

If you use C% to pass conditions from BASIC there's an important point to bear in mind. It's common to use 'TRUE' or 'FALSE' as BASIC conditions, and while 0 is the only value which is 'FALSE', remember that any other value is acceptable as 'TRUE'.

This means that the 'TRUE' in BASIC can be an odd or an even number and there's no problem. However, when machine code is called the carry flag won't be set if C% is 'TRUE', but even. In other words, BASIC's 'TRUE' condition can't be relied on to set the carry flag correctly – you must ensure that C% contains a suitable value. All even values clear the carry flag, odd values set it, so 'TRUE' doesn't necessarily mean carry set. Remember this inconsistency if you're to avoid ripping your hair out in frustration over a routine that 'looks as if it should work', but doesn't.

If this point isn't too clear, you can easily test it yourself. Try this little program and you'll see the difference.

```
10 FOR C% = 1 TO 2
20 IF C% PRINT "TRUE" ELSE PRINT "FALSE"
30 IF C% MOD 2 PRINT "TRUE" ELSE PRINT
   "FALSE"
40 NEXT
```

'USR' also provides an additional automatic facility, that of passing the final values of A, X, Y and P back to the BASIC program. This is why the format of the call is:-

```
result = USR address
```

where 'address' is the call address of the code and result is a numeric variable which will receive a four digit hex number representing the four processor registers when the call ends. An example will make things clear. We'll use osbyte &86 which returns the current line and character position of the cursor in X and Y. The osbyte call address is &FFF4, and the call number is &86, which must be in register A. No other parameters are required, so the BASIC commands are:-

```
A% = &86 result% = USR(&FFF4) PRINT
~result%
```

You will see an eight character result, representing the contents of registers P, Y, X and A. I've just tried this and result% contained &B1140086. Taking the four values from the left here's what they mean. &B1 was the value in register P, not very useful in this case. &14, was the value in register Y, the cursor's screen line, &00 was the character position in the line (pressing RETURN caused a new line) taken from X, and &86 is the (unchanged in this case) value in A.

We used an osbyte call for convenience, but any routine including your own can be called in this way. Remember, you don't set up the values to be returned from the routine, this is automatic with 'USR'.

Returning Results

Obviously in a real program the four register values can be extracted individually, and this provides an easy means to return single bytes from machine code to BASIC. The simplest way to do this is by using a mask and scaling, so to extract the Y, X, and A register values from result%, the statements:–

```
Y% = (result% AND &FF0000) DIV 256 ↑ 2
X% = (result% AND &FF00) DIV 256
A% = (result% AND &FF)
```

will do the trick. Notice that the mask size and the scaling factor relate directly to the position of the register to be extracted, since the purpose is to exclude the other bytes.

If necessary you can also obtain the settings of the processor flags to check conditions too, by using the value from register P and binary arithmetic. To isolate the status of a flag from result% you need to know the internal bit layout of register P.

Some of the flags are irrelevant in BASIC, their settings can be meaningful only in machine code. Of the 7 flags only N, V, Z and C can have any conceivable meaning back in BASIC, and most of the time you probably won't need them either, but for completeness here's register P's layout.

```
Flag N V – B D I Z C
Bit number 7 6 5 4 3 2 1 0
Hex. value 80 40 20 10 8 4 2 1
```

Bit 7, 'N', is the negative flag, set when the seventh bit in a result (A, X, Y or memory) is set. Bit 6 is the overflow flag, V, set when the result of arithmetic in the accumulator exceeds 255 (overflows). Bit five isn't used, bit 4 is the break flag, B, bit 3 is the decimal flag, D and bit 2 is the interrupt status. Bit 1 is the zero flag, Z, set when an instruction gives a result of zero, and bit 0 is the carry flag, set as a result of addition or subtraction in the accumulator, or by logical shifts or rotations of the accumulator or memory.

To extract the setting of one of these flags the arithmetic is more complicated and the explanation even worse. The complication is that the negative flag, N, can make the whole result appear as a negative when it isn't, so conventional arithmetic doesn't work. To save a long winded explanation, just treat the whole result as a 32 bit number (because we're extracting bits, not bytes) and scale it. For example, to isolate the carry flag the statement would be:–

```
C% = (result% AND &1000000) DIV 256 ↑ 3
```

To extract any flag, the 'AND' value starts with the Hex. value shown in the status register layout, hence the 1 in this case. If carry flag was set C% becomes 'TRUE', if not C% is 'FALSE'. (But again note that the results aren't boolean, ie zero and minus 1).

More Parameters

'USR' is fine for single bytes and simple conditions, but you'll sometimes want to pass larger quantities of data to or from your machine code. In this case 'CALL' is the choice, because it allows parameters to be included.

This is achieved by following the 'CALL'

statement with the required BASIC variables, separated by commas. For example to call code at &4000, passing the variables B%, data and name$, the command would be:–

```
CALL &4000,B%,data,name$
```

Information about the location of the variables is placed by BASIC in a parameter block in page 6, (&600) and your machine code can retrieve this to access the data. Address &600 always contains the total number of parameters, and starting at &601, each parameter is described in three bytes, in the form:–

```
bytes 1 and 2 start address (high byte – low byte)
byte 3 data type
```

Permitted parameters, and their types are:–

```
0 a byte – eg ?memory – address
4 a 32 bit integer – eg B% or !memory – address
5 a 40 bit floating point variable – eg data 128 a
string, in memory, terminated by &D – eg $text 129
a string variable – eg A$
```

For a string variable the parameter address actually points to a 'string information block' which itself describes the data. Four bytes are used, the first two are the start address, the third is the allocated size of the variable and the fourth is the length of its contents (which can be less than the allocated size). Although 'CALL' allows numerous parameters of various types, and on entry the 6502 registers are set up exactly as for 'USR', no values are returned automatically.

To pass results back to BASIC you must do it yourself. This means storing data at specified locations and retrieving them when you're back in BASIC. Use the same variables as the 'CALL' did by all means, but remember that the type can't be altered. Also, for string variables, the size can't be increased past the allocated size. If you need different data types or sizes you must use another location and retrieve the data by indirection.

Clearly certain operations are more awkward because of this, and only you can decide if it's worthwhile for your application.

Zero Page

Notice that in the speed comparison I used zero page locations &70 to &73 to hold the two addresses, without concerning myself about the previous contents. This is because BASIC is the current language, and &00 to &8F (plus, incidentally all of &400 to &7FF inclusive) is always the property of the current language. Fortunately BASIC is very helpful, and it leaves &70 to &8F for anyone to use. These locations, therefore, are always public property in BASIC, and you can quite legitimately use them for scratch workspace as you please.

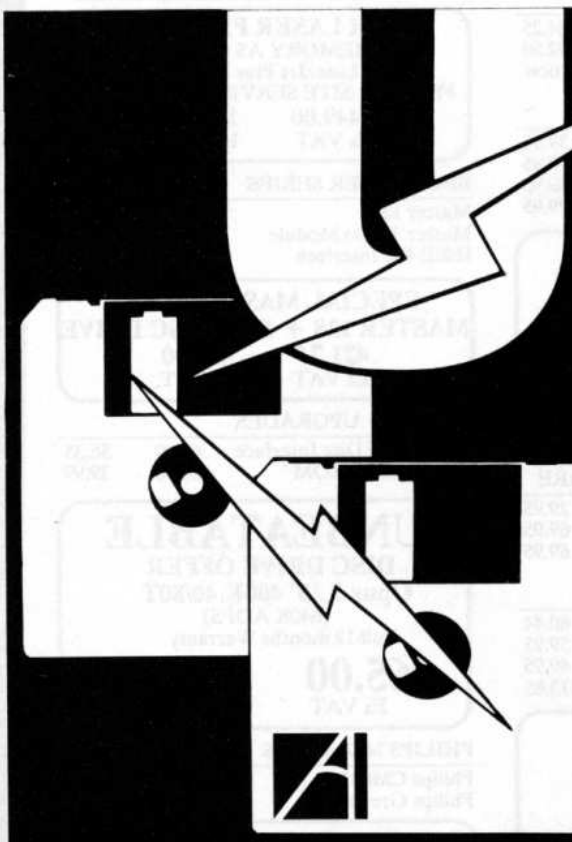
What you can't do is to store something there and expect it to be intact the next time you look, it may not be. Remember this area is public, which means it does not belong exclusively to you. In addition, this generosity by BASIC does not necessarily extend to other languages, so if your routines are expected to work with them you must not corrupt this area.

Zero page is vital to the 6502, since many addressing modes are possible only through these locations. For the reasons you'd need to look inside the 6502's design, but in simple terms zero page locations don't need a 'high byte' in their address, because it's always zero. This means the processor chip can hold zero page addresses in a single byte, instead of the two needed for all other addresses in the micro.

Luckily there are several other zero page areas which you can use, if you're careful. &90 to &9F is reserved for Econet, so this is usable unless you write programs which might run on a network. &A8 to &AF is OS scratch space, so you can use this too, but only if there are no OS calls while you do so. There are a couple of others, all documented in the books suggested at the beginning of the series.

You won't need this technique often, but if you write code for an unknown environment, effectively the situation for example when you write ROM software, extreme care is needed. You can't assume anything if you want to be 'legal' and compatible, and must leave user memory exactly as you found it. In this case store the zero page bytes needed on the stack as you enter the routine, then restore them all immediately before your final exit.

If that hasn't given you something to think about, next month things get more serious, as we move from called routines to standalone programs. We'll be looking at vectors, and techniques which can give your programs a continuous 'background' capability.



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Dave Reeder

Welcome!

It's a funny old thing, software. You get these odd months when, against all the odds, the strangest things emerge from the Stygian gloom that passes for the Beeb games market. Then you get the others. Like this month, for instance.

Here I sit, about two months to (whisper it!) Christmas. Just the time, you'd think, for software houses to have loadsagoodies ready for the gift market. The last minute present from the doddering aunt. The final treat for yourself because, Gods knows, you can't face buying any more matching socks and handkerchief sets for your uncle. You know, Christmas.

Enough of this idle banter, on with the show and the delights of *Strip Poker II Plus* plus four other gems for the month. Say what?

Game of the month

Due to the general lack of interest from software houses, Game of the Month has been suspended for this issue.

Winter approaches, the leaves fall and across the Beeb gaming nation the cry goes out – "Where are the great new games?"

THE ARCADE

By Fair Means Or Foul

Superior/Acornsoft Model B/Master/ Electron Tape/disk £9.95/£11.95/£14.95

Graphics/sound 7 Playability 7 Originality 8 Options 1/2 player Value for money 7 Lifespan 7 Overall 7

A slightly disappointing release from Superior, given that it's the start of the company's big run up to the end of the year. The game, by Michael and Terry Simpson, is original enough (and we'll come to it in a moment) but the inlay artwork looks rushed, the graphics are just adequate and, overall, the need to produce a game across loads of machine formats seems to have drained out all the potential originality.

That said, the idea of the game is original. It's a boxing simulation – quite good in itself, with player against computer or other player – with an added twist. And a big one at that – the whole idea of the game is to use dirty tricks against your opponent, just when the referee isn't looking!

That's a new one on me, I think. Aren't these games supposed to be teaching goodness and fair play, or is that another notion discarded by the greed generation? Okay, polemic over.

There are a number of allowed moves (head punch, body blow, upper cut and duck punch) which show how unpleasant boxing can be anyway – know what I mean, Harry? But it's the foul moves that really demonstrate the evil side of man's nature – the head butt, the kneeing, the kick and (ouch!) the groin punch. They make the game sufficiently different from other boxing simulations (er, Tynesoft's *The Big KO* is actually the only one I can recall at present, but then it is half past two and the wine bottle is empty) and it makes quite a neat addition to the games library.

BY FAIR MEANS OR FOUL
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I'm just not too convinced that this will appeal to a wide enough spectrum of Arcaders to give it better scores. There's nothing wrong with the game – it's just not outstanding.

Incidentally, Superior has taken over Alligata and will release Commodore, Amstrad and Spectrum games on a Superior/Alligata label; Beeb games continue to come from Superior/Acornsoft. No news yet of any possible rereleases from the Alligata back catalogue for the Beeb – but there were some interesting games, as I recall.

Clogger

Impact Software Model B

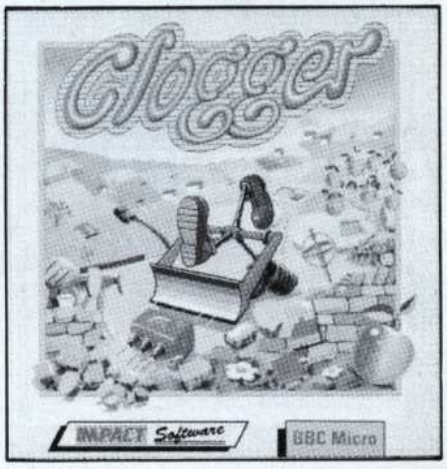
Graphics/sound 8 Playability 8 Originality 7 Options – Value for money 7 Lifespan 7 Overall 8

What? A new software house (run by ex-Superior Steve Botterill, so far only known for the recent Mark Gidley cheats and some game club or other) and a programmer new to The Arcade (Gordon Key) getting good points? You betcha! This is a very enjoyable game – even if it isn't the most wildly original offering for many a month.

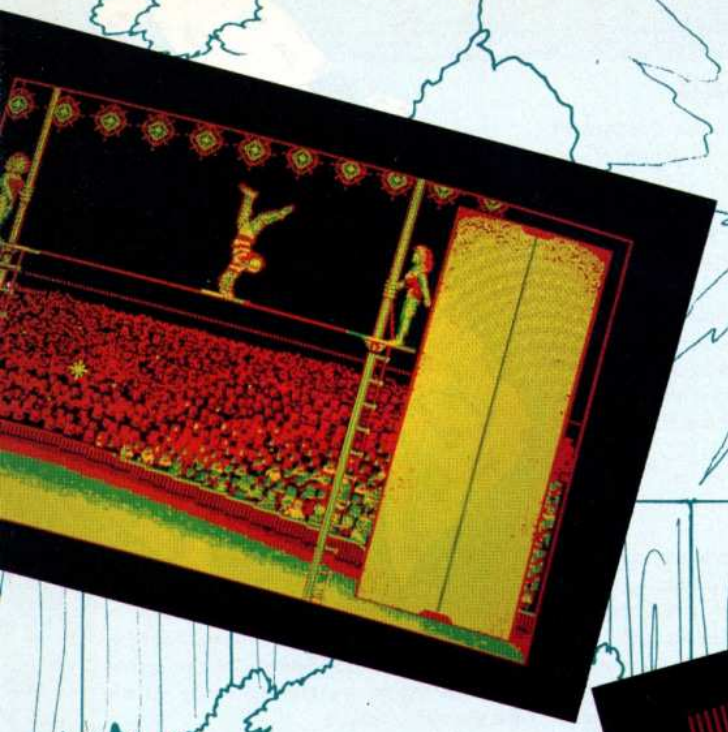
The premise is simple enough to explain quickly, I think. You play the role of a three-legged earth mover (whaaaaaaat?) and must clear levels of cakes and apples. So far, so like *Repton*.

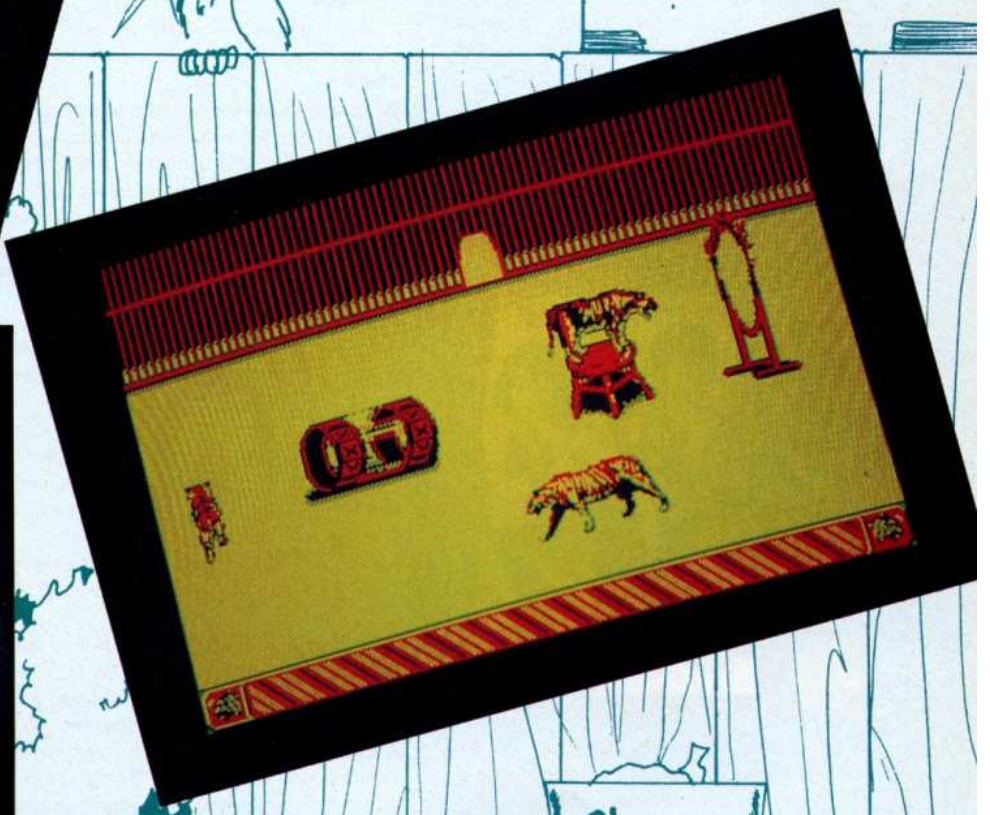
But there's more, much more. On each level you must assemble a picture made up of 21 blocks that you have to collect and move around the screen, whilst avoiding springs and cloggrass. There are hindrances like springs and gyroscopes, helpful stuff like buffers and drills and, if you can stand it, some fairly relentless but cheerful music. The graphics are great fun (especially the 'hero') and the gameplay is more cerebral than action-packed, given the time limit for each level.

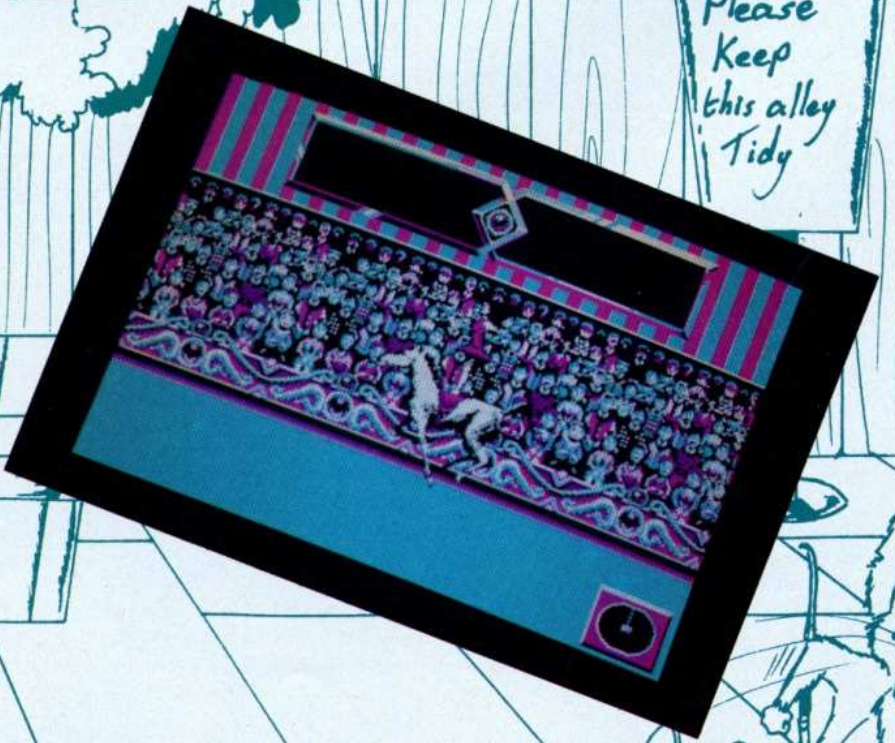
All in all, this is a very nice package – and welcome too for those who've been looking for a variant of the lizard or the like. I enjoyed it tremendously and look forward to persevering deeper into the 18 levels of the



arcade alley







Please Keep this alley Tidy

puzzle. Do search this one out.

Don't be put off by the packaging either. The game's a lot more fun than the dreadful story on the inlay suggests – "in a strange and mystical land", you must prove your great love of art (by collecting the pieces) and so become a Master Clogger. Cloggers, you must understand, have 'strange powers that enable them to perceive their environment in a way that is incomprehensible to man'.

Why do software houses feel the need to downgrade games in this way? Especially ones that are so refreshingly different, so well coded, so much fun? If anything, it would put me off (if I were in the business of buying games, like all of you) simply because it makes a thoughtful game look horrendously childish. End of whinge.

Strip Poker II Plus

Anco Model B/Electron Tape/disc £7.95/?

Graphics/sound 6 Playability 5 Originality 5 Options – Value for money 6 Lifespan 6 Overall 6

Here's one to keep away from your parents! Partly because it's smutty, partly because it's naff. That's a shame because Anco are new to the Beeb market.

You know the score when you buy a game like this – some fairly banal card simulation with the big thrill of seeing your digitised opponent shed first one, then another and then all her clothes. Wowsa!

Personally, I don't get too worked up over pixels on screen – too much else to entertain the mind these days. But what is sad is that Anco can release this knowing there will be a reasonable audience for such tackiness. And really. I wouldn't be half as bad, somehow, if the two 'girls' Donna and Sam were in any way attractive – no, this reminds me of nothing more than those ads in the back of video magazines for 'amateur housewives on film'.

It's not even a very good game of cards. Using cursor and return you choose whether to drop, call or raise on each hand and then decide how many cards to discard. Then, suspense mounting, you learn if you've won. There seems to be no skill involved – your opponent can be bluffed fairly consistently by betting high and thus giving the impression of a good hand. The only fun occurs when Donna or Sam has run out of money and 'has' to bet a piece of clothing or you are threatened with losing a pair of socks or something on the turn of a couple of cards.

But – and I ask the question in all seriousness – who's going to tell if you cheat?

One person determined to cheat is Dugald Holmes who sends in a way of viewing the six pictures of each girl without having to play a single hand of cards. You dirty dog, Dugald!

It's easy. Type MODE5 then LOAD" STRIP" then PROCsetup and then PROCIp ("x") – just a RETURN after each command, ignore the on-screen error messages and subsitute DONNA1 to DONNA6 or SAM1 to SAM6 for "x".

All I have to say is this – I'm not at all sure it's worth even that!

Preview Time

Coupla goodies for you this time – early versions of forthcoming releases from Superior and newcomers Black Knight: *Exile* and *Infinity*.

Exile has a lot to live up to. Already hailed as this year's megagame and with a teaser ad campaign in which the *Elite* and *Zarch* programmer, Dave Braben, says it is superb, etc. We ought then to be looking forward to this with keen anticipation.

I certainly was until I saw the demo screen that Superior had running at the PC Show; that was disappointing. It appeared to be some sort of cross between *Codename: Droid* and *Airwolf* - but maybe the fact that nobody on the stand had an idea how to play it, didn't help.

Now I've seen a later demo of the game by Peter Irvin and Jeremy Smith and it looks intriguing, although the graphics still seem a little blurred. But what is the game? Would you believe yet another arcade adventure, *Citadel* style? But this time complete with a background book all about the hostile planet of Phoebus which you must explore, doing the usual killing, avoiding and collecting, with an enhanced Master version available featuring sampled sound.

There is one vital difference, however, between this and other arcade adventures – here you never die, you are just teleported away to either one of four positions which you can save as the game progresses or back to the start. First impressions are of a very large and complex adventure. This could be great fun – I'm eagerly waiting for a shot at the full game. You'll realise from this preview that other "reviews" have been a little premature, although the full version will be available by the time this A&B hits the streets.

Infinity, on the other hand, I've been playing quite a bit – though that isn't saying

The Year Ahead

Issues of computer titles on sale this time of year always have some combination of the following:

A listing for some *Invaders* derivative featuring either/or Father Xmas, reindeers, snowmen or Xmas trees; a '12 days of Xmas' countdown of naff ideas, usually allowing salesman to call up printer manufacturers and say 'Yes, you do get a mention – now how about that double page spread. After all, it is Xmas'; a fill-your-stocking-with-the-year's-best-software-spread; or predictions for the year ahead.

So why should A&B be any different? Here, then, is The Arcade's predictions for 1989!

January: Superior announce *Repton's Run* featuring our favourite reptile shooting enemy soldiers, collecting diamonds and flying over the fungus thanks to the handy jet pack.

February: CDS make a product announcement (ie the actual game is six months away; if you're lucky> of the next classic – *Colossus Tiddlywinks 23.*

March: *Tynesoft brings us another 'completely original' sports simulation – Wheelchair Olympiad,* with hands free play an option.

April: Acorn User gets around to reviewing the games on show at the 1988 PC Show.

May: US Gold and Imagine announce 24 BBC titles for release over the next three months.

June: US Gold and Imagine issue a corrected press release. For 'BBC', please read 'Amiga and ST'.

July: Mark Gidley submits pokes to The Arcade for games not yet written.

August: A&B Computing suddenly prints a map that should have appeared in The Arcade in October 1988, but with no explanation of what it's doing there. The designer apparently cleared 'all the cups of coffee off the desk and there it was – so I put it in'. In a parallel coincidence, all the screen shots this month are the right way up and have the right captions.

September: Audiogenic claim that *Daxis* is "almost ready with just 98% of the game still to code".

October: Superior's big Xmas release appears: *(Rept)one for the money.*

November: *Micro User at last gets a game exclusive! It turns out to be another collection of Electron User listings, only half of which will actually run on a BBC.*

December: *John MacKay finally finishes Repoball.* The shock is too much for Dave Reeder who starts writing Z88 game reviews. A&B publishes an issue without pictures of either Clive Grace or Darrin Williamson. A version of *Elite* is released for the Psion Organiser and there is a rumour of a Beeb owner somewhere who still plays games.

Er, that's it. Happy Xmas and stuff like that!

too much as this arcade adventure by W. Scales and Jon Thornewill (both new names to me) has a total of 1024 (count 'em!) screens. These load in four batches of 256 screens, so I guess this is not a game to buy on tape.

Let's face it: this is a big game, and we don't even want to think at present of the enhanced Master version or how it might look on the conversions to C64, Spectrum or Electron, though the last is going to be pretty interesting. The object is simple (isn't it always that way?). To escape from the planet you must collect six pieces of a radio dish, assemble them and then call for help. No problem. Well, to be honest, there is a problem or, to be even more honest, a number of them – more than 50 puzzles to solve, more than 30 different kinds of aliens to defeat, more than 128 objects to discover and more than 256 different background blocks to wonder at. Now with a game that size, you're not going to finish it at a sitting so the coders have thoughtfully provided a save game routine.

But how does it play? Pretty well from where I'm sitting. On the *very advanced demo* I've seen there's an option to choose Modes 1 or 5 (remember *Spy Hunter*?), but I'm not sure if that will remain. Once into the game, however, and the fun begins. The graphics are large and fairly detailed and the movements available (left, right, up, down, jump, collect, use object) soon have the hero moving with dexterity up and down the trees and ladders, along the passageways and over the obstacles.

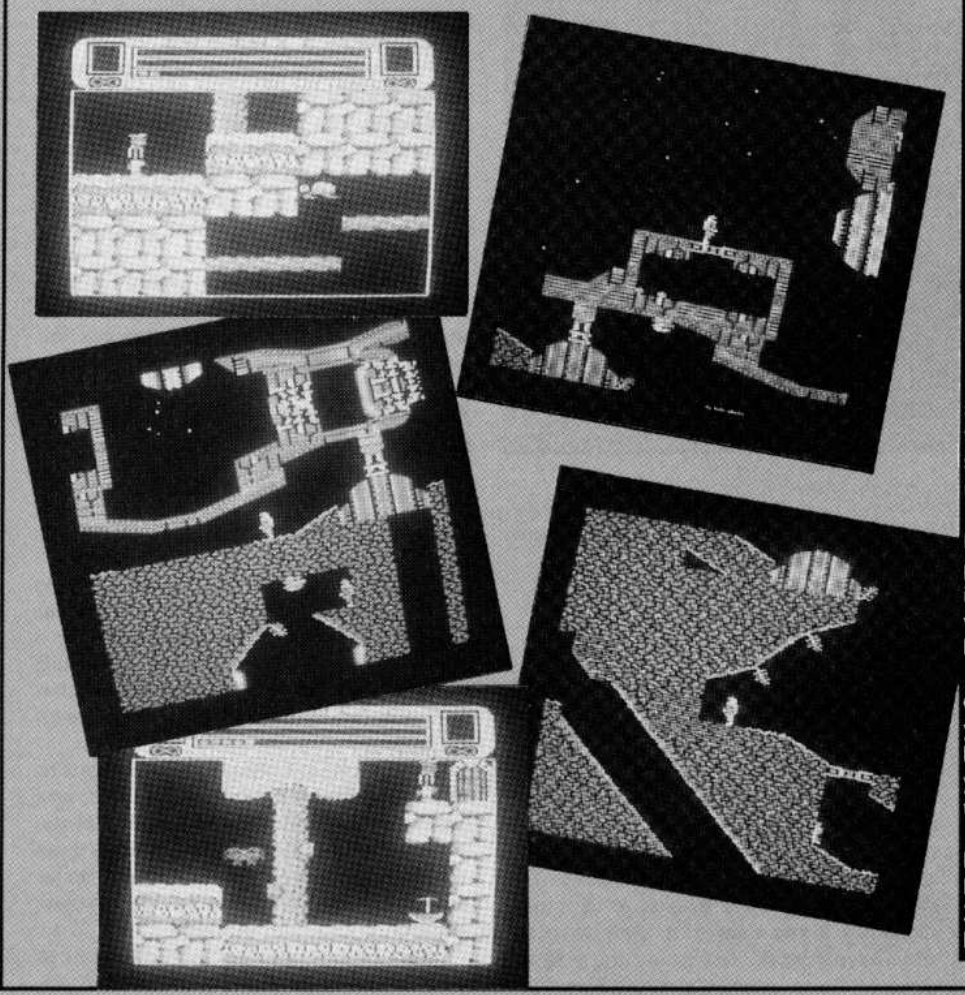
In essence you're going to be reminded of Citadel (again) if only because the first problem involves finding a way through a solid wall and large parts of the game take place in tunnels and caverns under the ground. The aliens may look unpleasant but their patterns are soon predictable, leaving the initial concern of the player to explore and (hopefully) map the large number of screens.

Maybe that's too many to cope with. I'm not sure but, map or not, it's going to be hard to recall the right route every time.

For my taste the graphics (especially of the main character) are a little crude but that, I guess, is the payoff against size. It certainly plays well and with much to explore and come to grips with, this is going to please many of you for quite some time. It's reminiscent of a number of other games but is clearly going to set a new standard in the complexity of arcade adventures.

Did I mention the secret passages? There are secret passages and a tree that needs watering and an extra life fish and all sorts. I don't know who these programmers are but they are certainly names to watch. Black Knight is to be congratulated in regaining the high ground after a number of, for me, disappointing releases.

I know it's early days and all that, but I think Infinity will be even more popular than Exile. I await the final, final version with keen interest and meanwhile, lads, could I have an infinite life version, please? I think I'm going to need it.



And Finally

And finally, we come to the end of yet another Arcade – the pause that refreshes, or something. Next month I guess we'll have to do the cliched 'Best of the year' or something similar.

We might also begin a new era in reader involvement. Of late (and I've noticed) the arcade mailbags have been getting a tad lighter, your sizzling tips, your desperate cries from the hearts of the lovelorn, whatever. I'm sorry, that's just not good enough.

I mean, here am I, some two years after I began hacking out these pages, and nobody sends their 'best ten games of all time', no female readers send nude pics with illicit suggestions (speak for yourself! – Ed), nobody-it seems – exists out there any more.

But don't worry. There's a way of lightening the heart of your humble correspondent and it's real easy. All you have to do is write in with tips, hints, pokes, maps, wacky stuff, whatever and we'll see what happens.

'Cos otherwise I might have to get 'boy editor' Mark Webb to write an Arcade for you – and then where would you be? With half a dozen pages about which printer gave you the best print out of your reviews – that's where you'd be.

So, as a final gasp for sanity, write to me: **Dave Reeder, A&B Computing, ASP Ltd, 1 Golden Square, London W1R 3AB.**

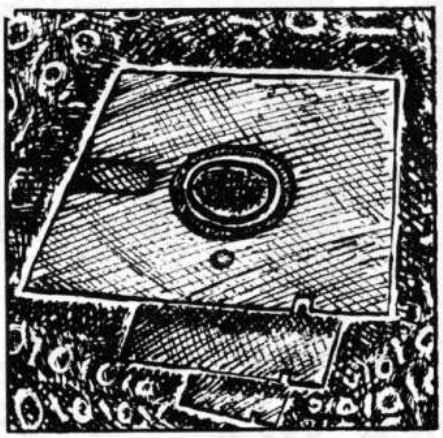
Do it now – you know it makes sense.

Soft Ware

Spellmaster Z88 Computer Concepts

The Cambridge Computer Z88 seems to have gained acceptance as the portable micro to complement BBC Micros in homes and schools. Software support is still a little sparse but Computer Concepts have recently helped out with a conversion of their Spellmaster spelling checker package.

Spellmaster fits effortlessly into the menu driven environment, the two applications, Wordfinder and Quicktext appearing as items on the INDEX. The programs are easy to use with online help provided. The software is delivered on cartridge and is accompanied by a practical and well written guide.



Check from cursor
Check this word
Check marked block
Check as you type

WAREHOUSE

Quicktext is a basic wordprocessor, without the row/column features of Pipedream but with everything you need for basic typing and editing. In fact for writing you may prefer Quicktext's lack of rigid formatting. There's also a handy information window with number of lines, words, memory free and user dictionary (see later). A document can be saved in a "plain text" format suitable for transfer to Wordwise or Interword on the BBC. Text can also be transferred via RAM disc to and from Pipedream.

Inside Quicktext you can call up the spelling checker menu and choose from these options:

Check all text

Each has an equivalent <> key command. The filing menu has

Load user dictionary

and

Save user dictionary

options.

Checking as you type results in a beep if the checker fails to recognise what you have typed. Pressing ESC takes you into the correction menu.

When batch-checking, if the checker finds a combination of characters it doesn't recognise (from its approximately 60,000 word dictionary) then it offers five choices. You can ignore the word or add it to a user dictionary if you think it is likely to occur often in your work. You can set the program looking for other possible alternatives which can be chosen to replace the word currently present. Or you can edit the text manually before continuing with the check. The fifth option is to browse through the dictionary. This sequence takes place whenever a word is not recognised.

By adding an unrecognised word to a user dictionary you can quickly "teach" the spelling checker your regular vocabulary.

Wordfinder is called up from the INDEX or by <>W, it offers:

Browse through dictionary
Solve anagram
Guess Word
Solve Crossword

Very handy for the travelling computer user and who is to know that you are not hard at work? These puzzle-solving functions take about 20 seconds to leaf through the 60,000 entries. Let's give Wordfinder a simple anagram to solve:

ARED

DARE, DEAR and READ pop up pretty quickly.

Find a close match:

FRENCH

DRENCH, FRENCH, TRENCH and WRENCH are displayed.

Solving a crossword involves wildcards. # represents a single unknown letter, * a group of unknown letters. For instance trying

***OLOGY**

gets a good response!

F##LD

reminds you it's FIELD just in case you have a mental blank on this or another word's actual spelling.

Spellmaster is a useful addition to the Z88's facilities. The provision of an alternative wordprocessor was surprising but justified in my opinion. The speed of checking, the user dictionaries which can be edited and the seamless integration of the software mean that Spellmaster earns its cartridge slot by the side of EPROM and RAM packs. Price £59.00 inclusive.

The problem now is where is the database going to go when Minerva deliver their offering? Z88 owners, watch out for further instalments in the Warehouse!

Beeb-Planner Model B/sideways RAM and Master 128
E.J.Sheffield

This is a menu driven project planning package that runs on the BBC microcomputer with the addition of sideways RAM, or a Master. It provides a means of calculating how long a project will take and how much it will cost to complete using critical path techniques.

The first step in planning any project is to draw the network diagram as it is called, on a piece of paper to show the topology of the activities. Once this has been done, these activities can be entered intoBeeb-Planner and processed to calculate the project duration, critical path and cost.

Beeb-Planner allows activity durations to

be specified in units of days, with any one of three calendars representing a five, six or seven day working week. The total duration of a calendar can be in excess of four years, and can run through to the year 1999. In addition, up to twenty holiday periods can be specified on a calendar by calendar basis when scheduling should not take place.

The holidays can be included, or excluded during a run as required. If costs are applied to activities, then a cost schedule will be calculated, and can be output to a suitable printer on a week by week basis, as well as to a file for passing to another program.

In addition to the above cost report, the time schedule can be output in a number of ways; to the screen on an activity by activity basis with selection being controlled by the user, or to a printer. If this last option is chosen, then all activities are output in either a tabular fashion or as a bar-chart and can be sorted into a number of preset orders. In addition, an activity listing can be printed, providing a topological check list.

Beeb-Planner provides screen facilities to input, update and amend the network logic, as well as activity cost. Progress can be reported by changing activity durations, and deleting activities once they are complete. Because analysis of the network only takes a few seconds, the program will re-analyse it following each change giving instant access to the effect of the change. Alternatively, changes can be input as required and then the project re-analysed once they have all been made.

Beeb-Planner allows target dates to be specified as either 'early start' or 'latest finish' targets to influence the calculated schedule. Whether or not these target dates are included is under user control.

A further option allows the inclusion or exclusion of non-working time in the calculation of float.

Many of these facilities allow 'what if' situations to be analysed.

Beeb-Planner (version 8 described) is available at £39.95 from: E.J. Sheffield (Mrs), 8 Langdon Close, Camberley, Surrey, GU15 1AQ.

Book Ware

The Desktop Guide to Desktop Publishing by John Walker, offers a crash course in DTP and delivers very successfully. There are full to bursting appendices with useful terms, names and addresses, software and hardware lists, not all BBC but mostly relevant.

The Desktop Guide has chapters on typography, style, graphics, graphic aids, layout, makeup, printers, DIY, Mac and IBM and cheaper systems (that's us!).

One slight disappointment is the book itself which utilises block paragraphs, computer printout style, and displays little in the way of imaginative layout – the fact that it was produced on an Amiga might explain this!

Of course clarity is an important aim in DTP too and The Desktop Guide can certainly boast it in both layout and writing style. You'll certainly come away with some ideas and a good understanding of what can and can't be done with DTP.

Price £8.50 from Glentop Press Ltd, Standfast House, Bath Place, Barnet, Herts EN5 5XE.

Making Logo Work is by Janet Ainlye and Ronnie Goldstein, with the acknowledged help of the students and teachers at Trinity comprehensive school in Leamington Spa, Warwickshire. The authors conjure up an imaginary school in order to investigate various aspects of using the Logo computer language and to allow the reader to form an opinion of whether Logo might be introduced in their school. There's a description of the students at work and of a staff meeting.

Childrens work from the real Trinity comprehensive is described with example printouts and the programs which created them side by side. There is a continuous commentary on how children's work progressed and what teaching methodes were used. The teacher's role is discused from a practical point of view, setting up equipment, room layout, assigning computer time, work away from the computer, setting appropriate challengs and son on. All very useful for anyone new to teaching in the "logo environment".

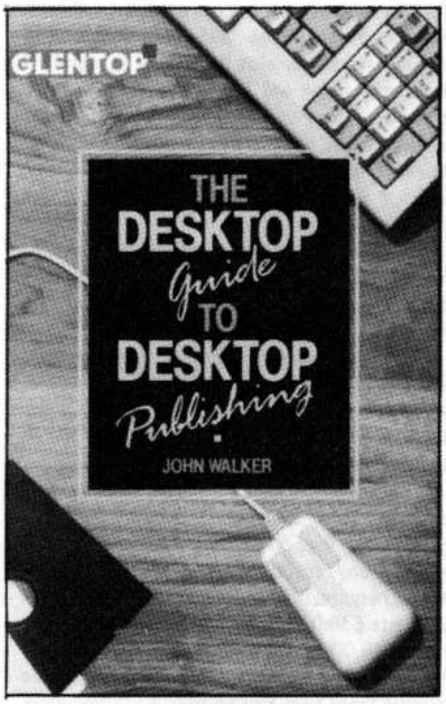
There's a complete chapter on turtles and "turtle graphics" appear in many contexts throughout the book. Two long chapters on the mathematical content of logo and demonstrating mathematical approaches with logo are marvellous to work through, full of ideas, examples of work and programs to try. As before the authors describe the reaction of children and the ways that results were achieved, or not. It becomes obvious that trial and error with logo can be as much fun as the final success. Structured programming and Microworlds each get their own chapters. The latter touches on using Logo for control, music and geometry. There's unfortunately nothing on using Logo for list processing or language work. The large format book has an excellent reference section and index, completing an excellent practical introduction to classroom Logo for teachers.

Price £5.95. Available from Basil Blackwell, 108 Cowley Road, Oxford, OX4 1JF. ☎ 0865 791100.

For anyone embarking on wordprocessing with their micro, my attention was recently drawn to **Word Processing Practical Exercises** by Anna Ruthven, published by the National Extension College. This isn't your normal tutorial but a wide range of common examples of layout, subject matter and presentation. The exercises are presented on a large format pad with a ring binder so you can easily flick through them. Wordstar was used as the "standard" but all the phraseology applies to any wordprocessor you may have. This seems ideal for schools and colleges and the small business could do much worse.

Price £3.95 from NEC in Cambridge.

The **Skills in Practice** series from Mcgraw-Hill has a Computer Literacy editon for students studying CPVE, YTS, RSA and GCSE courses. A teacher's manual (£29.95) advises on how to run a computer literacy course and there is BBC Micro software as well as the student guide (£4.95). We had to like the student guide because it features a copy of A&B Computing on the front! In fact



it's a very readable introduction to computer systems of all sorts, hardware, software, peripherals, operating systems, networks, programming, computer applications in industry and commerce along with issues like data protection.

Available from McGraw Hill Book Co. Shoppenhangers Road, Maidenhead, Berkshire, England SL6 2QL. ☎ 0628 23432.

From the University and College publishing arm of McGraw Hill comes a solid little 126 page publication by Josephine Shaw: **Word Processing and Computer Training Techniques**. This is for the supervisor who has to turn trainer but without any experience of skill training. The book is designed to give the reader the techniques for one-to-one or small group training on pcs/wordprocessors and to evaluate the progress of students.

Hard Ware

Four podule backplane Archimedes IFEL

Difficult to review a backplane but easy to see the advantages of having four podule slots as against the two provided by Acorn for the Archimedes 305 and 310. A440 owners get a four slot backplane as standard so what is going on? There is a mounting bar to take a four slot backplane and power enough from the Power Supply Unit. Our four-slot back-plane provided room for four podules which worked without hitch. The choice is yours.

A typical podule combination might involve I/O and IEEE for the science lab. But what about a hard disc and a digitiser for recording during the experiment?

A businessman is going to want a hard disc partitioned for use with MSDOS but at home it's then an argument over MIDI for the Casio or digitiser (especially now it can handle colour) for the CAMcorder.

For an extra £20.00 IFEL's four podule backplane can solve the problem and it is guaranteed for one year. IFEL can in fact provide any combination of backplane you might require. Their 2-way backplane with fan costs £38.00, their four podule backplane costs £48.00 on its own or £58.00 with fan. Add VAT and postage at £1.00. An upgrade scheme from two-slot to four is in operation. Contact IFEL on ☎ 0752 847286.

3½" disc drives Model B/B+/Master Watford Electronics

This design must surely win "slimmer of the year" for computer hardware. There's nothing to these drives and they appear only just big enough to get the disc in! They are also very quiet. Bear in mind that the drive takes its power from the BBC auxilliary port and order an adaptor if it's already in use.

We put the drive through its paces using our own set of nine disc benchmarks:

1. SAVE 16K
2. LOAD 16K
3. OPEN/CLOSE 100 TIMES
4. PRINT# 1000 TIMES
5. INPUT# 1000 TIMES
6. PRINT# 80 BYTE $ 100 TIMES
7. INPUT# 80 BYTE $ 100 TIMES
8. BPUT# 1000 TIMES
9. BGET# 1000 TIMES

The tables show both DFS and ADFS timings for the Watford 3½" drive and for our office 5" drive. They show that there is no outstanding increase in performance just because it's 3.5". The other advantages are plain: more reliable media, small footprint (the drive could just rest on top of the computer), compatibility with Master Compact and Archimedes and a good price: £69.00 + VAT. A double drive costs £126 + VAT.

Benchmark	Time in secs
1	3.91
2	3.91
3	2.35
4	7.19
5	6.66
6	10.90
7	9.51
8	4.55
9	3.61

3.5" DFS

Benchmark	Time in secs
1	5.06
2	4.00
3	4.52
4	13.52
5	6.27
6	24.88
7	9.04
8	7.11
9	3.56

3.5" ADFS

Benchmark	Time in secs
1	3.61
2	3.81
3	2.15
4	7.04
5	6.33
6	11.23
7	9.45
8	4.68
9	3.55

5.25" DFS

Benchmark	Time in secs
1	4.60
2	3.53
3	4.05
4	13.06
5	5.82
6	24.45
7	8.59
8	6.66
9	3.10

5.25" ADFS

The benchmark listing. Try it out on your drives and send us the results with make of drive, interface and filing system used for our Warehouse records.

FX850 BBC Micro/ Archimedes Epson

This printer is the latest, and perhaps last in the long series of Epson FX series 9 pin dot-matrix printers. Latest, because the FX 850 is the heir apparent to the long lived FX80, which has been around for ten years or so. Last, because by the time Epson get around to replacing this particular model in about five years time the market for 9 pin impact printers will have ceased to exist altogether.

What then does the FX850 has to offer

Two NLQ typefaces are offered, Epson Roman and Epson Sans Serif. Both are certainly a great improvement on the draft typeface, which in this age of laser printers looks distinctly poor. I had a slight preference for the Roman version, but you may disagree with me. For general correspondence the NLQ print is fine, and in fact unless you are churning out great volumes of printout, then I would stick to one of the NLQ typefaces for the advantages of greater legibility. If you want to branch out and use one of the many DTP packages or font programs available, then of course the Epson is *the* standard for compatibility, and should run everything. However with an eye to the feature, this printer is *not* compatible in graphics mode with the many 24 pin printers now available, not even Epson's own. This could mean that as people gradually switch to the 24 pin standard, then users of the 9 pin standard will be left behind.

With regard to physical attributes the FX850 is a typical Epson being solid and well built, without having too much of a high tech feel to it. The printer is supplied with a push tractor as standard, but a pull tractor is available, and a sheet feeder is an optional extra. Cut sheet handling is much improved, and you can now switch from continous to single sheet paper *without* unloading the continuous paper.

One minus point is that it is still very noisy in use, especially in comparison to Epson's own GQ 3500 laser printer, so I would not recommend putting this printer next door to your computer, it could drive you crazy! Overall though, a very capable workhorse, that will no doubt remain in use in offices and homes until the end of this century, and beyond.

Featurewise the FX850 now boasts automatic paper handling, ie it will load and eject paper without interference from the user. This will either delight or dismay you according to taste. Personally I hated it, but you can turn it off using a DIP switch. The *Selectype* panel on the top of the printer has been expanded to include control of such functions as the typeface used, and the pitch. The settings are remembered when the printer is switched off.

Epson UK Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH ☎ 01 902 8892

Time to print 1357 word article complete with formatting codes (seconds)

	Draft	NLQ1	NLQ2
Epson FX850	78	212	213
Smith Corona D100	140	---	---

Time to print out Fontworks demo (seconds)

FX850	40s
Smith Corona	61s

Time taken for Mode 5 screendump using Snatch utility (seconds)

FX850	111*

*substantially quicker than as specified in the Snatch manual

FIXING THE FIGURES

Graham Kendall

Place Your Bets Please

In the last issue we looked at the process we need to go through to develop a computerised gambling system. In this issue we are going to do just that. We will start with roulette as it is probably the easiest thing to program. Before we begin we should know how roulette is played. We should also be aware of the house edge. As you will recall the house edge is the means whereby the casino guarantees it will win money.

The basics of roulette are very simple, so I won't bother to go into the rules. All we are required to do is to predict which number the ball will land in on the wheel. If it sounds impossible to predict the precise number there are a variety of bets we can make to cover more options. We can try to predict the colour of the number. Our alternatives being red or black. Or we can attempt to predict whether the number is going to be odd or even (zero does not count as even). Another bet we can choose is to say whether the number is going to be between 1 and 18 or 19 and 36. All bets are known as even chance bets and cover eighteen numbers in one bet. You will have noticed that none of them cover the zero.

Another bet allows you to cover twelve numbers with one bet. With this type of bet you can either cover, what are known as, dozens or columns. When you bet on dozens you are covering the numbers 1 to 12, 13 to 24 or 25 to 36. With a column bet you are covering every third number on the wheel. Therefore if you bet on column one you will be betting on the numbers 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31 and 34. By betting on column two you are covering the numbers 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32 and 35. Betting on column three, not surprisingly, allows you to cover the remaining numbers with the exception of zero.

Obviously different bets attract different payouts. If you bet on a single number, and win, you are paid at odds of 35-1. On an even chance bet, where you are covering eighteen numbers, the odds are 1-1 (evens). Betting on twelve numbers (columns or dozens) attract odds of 2-1. Now we understand the fundamentals of roulette we can take a look at the house edge.

For a casino to stay in business it must guarantee to win money. It does this by under paying you when you win. This can best be seen if we look at betting on a single number. If you were to bet on the number 17 and it won you would receive a payout of 35-1. Therefore you would receive 36 chips. This consisting of your original chip plus a payout of 35 chips. As there are thirty seven numbers on a roulette wheel the correct odds for predicting the correct number are actually 36-1. So you can see even when you win you are still losing money as the casino is under paying you.

A similar thing happens when you back twelve numbers (ie. dozen or column bet) though it is easier to look at the house edge if we look at the effect zero has on such a bet. If you win on a dozen or column bet you are paid at odds of 2-1. However if zero comes up everybody who has placed a column or dozen bet loses their money. If the zero were not on the wheel the odds of 2-1 would be the true odds for this type of bet. With zero on the wheel however the odds are slightly more than 2-1. Therefore because of the zero the casino has given itself a house edge.

Even chance bets also suffer the same fate when a zero comes up. If it were not for the zero the odds of 1-1 would be correct. When the zero turns up however the casino takes all money placed on even chance bets thus giving itself a house edge. (There is a special rule concerning zero and even chance bets but for now we will assume the casino wins.) So you can see the house edge in roulette comes by virtue of the fact that there is a zero on the wheel. If no zero was present the even bets would truly be an even bet. Also by removing the zero the payout on a single number of 35-1 would be correct and the dozen and column bets at 2-1 would also be correct.

If we worked out the house edge we would find it comes out at about 2.5%. Compare that to something like horse racing, which can come out at twenty percent or more, and at first sight roulette offers the punters a good chance. In fact at 2.5% the house edge in roulette seems remarkably good value. What we need to bear in mind though is that the 2.5% house edge is working in the casinos favour all the time. Convert this to money and the casino should take 2.5% of all money that passes across the table.

Now we roughly know how roulette works and the house edge we are operating against we can consider whether it is worth taking the plunge and trying to design a computerised gambling system. I would suggest that 2.5% is a sufficiently small house edge to give it our serious consideration. We will throw ourselves it at the deep end and try to devise a system that will enable us to predict the next number that is going to turn up. Our aim is to do that at least once every thirty five spins. If we can achieve that we will make a profit. If we cannot manage it we will make a loss. At least that part of the mathematics is simple.

To do any form of forecasting we must keep records of past events. The trick is to find the formula that will provide the answer to what is going to happen next, by looking

at what has already happened. Our first problem is to decide what information we need to keep. As a starter I decided it would be worth storing whether the previous numbers were red or black, whether they fell in the first, second or third column and finally whether the number fell in the first, second or third dozen.

Having decided what information to record I designed the rest of the program from that starting point. The easiset way for you to understand how I went about this is for you to look at my completed program and you will see how I tackled the problem. Up to line 100 controls the rest of the program. The first time the program is entered PROCINIT is run. If the user decides additional runs are required, the program will not run PROCINIT again but will run all the other procedures. PROCINIT (line 110-170) DIM's 4 arrays. A$ will hold the data stored in lines 1050-1410.

Each line of the data holds information about one of the numbers on a roulette wheel. The first item is the number itself. The second item indicates whether the number is red or black. The third item indicates which column the number falls in and the fourth item indicates which dozen the number is in. Once PROCINIT has been processed the array A$ will hold this information. The array BET$ which is DIMed in PROCINIT is used as a temporary storage area when the program is trying to decide which number it should bet upon. Its use will become clearer a little later.

The two arrays STATS% and STATS1% are used to hold statistical information which is printed out at the end of the program so that you have some indication of how the program arrived at its conclusions. Again you will see their exact use a little later. PROCINIT1 (line 180-240) sets various variables to zero. This procedure is run every time the user requests another run. If the totals were not zeroised we would be working with cumalative figures which we do not want to do. PROCSPIN (line 250-270) asks the user how many spins the wheel should make. The variable SPIN% is used to hold your answer and is later used to control a loop which spins the wheel. PROCGAME (line 280-460) is the meat of the program. The procedure has a loop in it which is controlled by SPIN%. The first thing the procedure does is to call PROCCHOOSEBET. This procedure returns a number in NUMBET%. If the number returned is -1 this indicates the program has decided not to bet on this occasion. In fact this will be the case on the first few spins as the program will not have built up sufficient information to make a decision on which number to bet upon.

If the number returned is not -1 (ie. the program has decided to bet) then MONEY% is decreased by 10 units. This is the equivalent of us placing a bet. You will have noticed that during the initialisation phase MONEY% was set to zero. Obviously when you go into a casino you would not go in with zero money. However for our purposes it makes the results easier to understand. If we end up with a negative value we have lost money. If we end up with a positive figure we have made money. Breaking even is indiacted by MONEY% being equal to zero. PROCGAME then chooses a number, at random, between 0 and 36. This represents the roulette wheel spinning. If the number returned by PROCCHOOSEBET and the random number match then MONEY% is increased by 360 units and WINS% is increased by 1. WINS% is a variable which we use to hold the total number of wins. MONEY% is increased by 360 which represents the casino paying us out at odds of 35-1 (we also receive our original ten units bet back). If the numbers do not match then LOSSES% is increased by 1. Similar to WINS%, LOSSES% is used to keep a tally on our losses.

The remainder of PROCGAME is concerned with collecting statistics. Each element of STATS% is used to hold the number of times each number occured. As an example if the number 17 came up then STATS%(17) would be incremented by 1.BP STATS1% is used similarly, but each element is used to keep a tally of the numbers that were bet upon. NO-BETS% is incremented if a bet was not placed and conversely BETS-PLACED% is used to hold the number of times a bet was placed. Each line between 370-440 is looking at one aspect of the number that was spun and logging the information away to various variables. These variables are consulted later in the program when trying to decide which number to bet upon. PROCCHOOSEBET (line 470-610) is another important procedure.

It contains our selection formula. If you read the first article in the series you will know this is the means whereby we try to ascertain which number we should bet upon. As this procedure is the reason for this article we will delay its discussion until we have looked at the rest of the program. PROCPRINT (line 620-770) runs once the roulette wheel has completed the requested number of spins. It displays to the screen various information which the user might find useful. Without doubt the most important piece of information is how much money we have won or lost. As I have previously stated if a negative figure is shown then we have lost money. If we are presented with a positive figure then we have made money.

PROCPRINTSTATS (line 780-870) displays a screen which shows how many times each number appeared. PROCPRINTSTATS1 (line 880-970) does a similar job to PROCPRINTSTATS except the figures shown are the numbers that were actually bet upon. The only other procedures in the program (PROCNEXTSCREEN and PROCPLAYAGAIN) are routines which keep the program running smoothly.

The selection formula we mentioned earlier is written within PROCCHOOSEBET. Now we have the basics of our program built we can consider our selection formula. It is based on the theory that you can predict the next number by looking at what has happened before. To do that we consult the information we have been collecting. My theory runs something like this. If we have had more red numbers than black then a black number has more chance of appearing on the next spin. Similarly with columns. If we find that one of the columns has appeared less than the other two then that column has more chance of appearing on the next spin on the wheel. The same goes for dozens.

Once we have identified a suitable colour, column and dozen we then try to find a number which fits all three categories. If we can find such a number then we back it. That is the theory. How does PROCCHOOSEBET do this? Firstly it compares the number of reds that have appeared with the number of blacks that have appeared. If it finds one is less than the other it sets that colour as its preferred choice. For example if red had occured more than black then black becomes the preferred choice. In this instance a "B" would be written to element 1 of BET$. A similar exercise is carried out for the dozens and columns. In both of these instancs it is trying to identify the column and the dozen that has appeared less than the other two. If any of the above tests fail, for example number of reds equals the number of blacks, then the procedure returns a value of -1. This indicates the procedure does not wish to bet. If the procedure comes up with a preferred colour, column and dozen it can then begin to search for a suitable number on which to bet.

An example might make the process clearer. Let us assume blacks have predominated over reds, column two has appeared less than both column one and three and dozen one has appeared less than both the other dozens. Once the program had came up with its preferred choices the elements of BET$ would contain this information in the form R,2,1. This represents red, column 2 and dozen 1. The procedure now searches through A$ (which holds the details about each number) until it finds a match with BET$. In this particular case a match would be found against number five. As you can see from the DATA lines the number five is red, it falls in column 2 and is in the first dozen. Once the procedure has found a suitable match it returns the number in NUMBET%. If no match can be found a value of -1 is returned indicating the program will not make a bet on this spin.

In summary, then, what are we doing? Firstly we are sampling every spin of the wheel and collecting three sets of data. Based on that data we then search for a number which we think has more chance of coming up than any other. If we find such a match we bet upon it.BP Does it work? I will not bore you with lots of results. Suffice to say it looks promising. Whether you would trust it in a casino though is only a decision you can make.

The selection formula I have given above is only the tip of the iceberg. The ways it can be developed are almost limitless. By some changes to PROCCHOOSEBET and maybe some chamnges to PROCGAME it will be very easy for you to develop your own selection formula. For example you may decide that simply comparing reds against blacks is not good enough. You might want one colour to have come up at least ten more times than the other colour before betting.

Another thing you might want to consider is looking at the way the final number to bet upon is decided. If, for example, we were looking for a number that was red, in the first column and in the first dozen we would get

the number 1. However number 7 also meets this criteria but as we end our search once we have found a suitable number we will never bet on 7. Would it be more sensible to find all possible numbers and then use some other method to decide between them? Or maybe we should spilt our money and bet on all possible numbers?

So far I have designed a system. It is up to you Test, Review and then Amend it. If you do your work correctly you will either come up with a winning formula or reach the conclusion that trying to predict the next number is an impossible task. The only thing I suggest you try is to change line 290 from

FOR CNT%=1 TO SPIN%:PROCCHOOSEBET
to
FOR CNT%=1 TO SPIN%:NUMBET%=RND(37)-1

This has the effect of not letting us have the benefit of our selection formula and making the number we bet upon totally random. If you played a casino under the same conditions you could expect to lose. It will be interesting to compare the random selection of numbers against the best selection formula you can come up with.

```
   10 PROCINIT
   20 PROCINIT1
   30 PROCSPIN
   40 PROCGAME
   50 PROCPRINT
   60 PROCPRINTSTATS
   70 PROCPRINTSTATS1
   80 IF A$="F" OR A$="f" THEN
 END
   90 GOTO 20
  100 END
  110 DEF PROCINIT
  120 DIM A$(36,4), BET$(3), S
TATS%(36), STATS1%(36)
  130 FOR I=0 TO 36
  140 FOR P=1 TO 4
  150 READ A$(I,P)
  160 NEXT P,I
  170 ENDPROC
  180 DEF PROCINIT1
  190 RED%=0:BLACK%=0:COL1%=0:
COL2%=0:COL3%=0:DOZ1%=0:DOZ2%=
0:DOZ3%=0:NO_BETS%=0:BETS_PLAC
ED%=0:MONEY%=0:NUMBET%=0:WINS%
=0:LOSSES%=0
  200 FOR CNT% = 0 TO 36
  210 STATS%(CNT%) = 0
  220 STATS1%(CNT%) = 0
  230 NEXT
  240 ENDPROC
  250 DEF PROCSPIN
  260 CLS:PRINT TAB(0,5)"How m
any spins would you like the w
heel to make";:INPUT SPIN%
  270 ENDPROC
  280 DEF PROCGAME
  290 FOR CNT%=1 TO SPIN%:PROC
CHOOSEBET
  300 IF NUMBET%<>-1 THEN MONE
Y%=MONEY%-10
  310 NUM%=RND(37)-1
  320 IF NUM%=NUMBET% THEN MON
EY%=MONEY%+360:WINS%=WINS%+1
  330 IF NUMBET%<>-1 AND NUM%<
>NUMBET% THEN LOSSES%=LOSSES%+
1
  340 STATS%(NUM%)=STATS%(NUM%
)+1
  350 IF NUMBET%<>-1 THEN STAT
S1%(NUMBET%)=STATS1%(NUMBET%)+
1
  360 IF NUMBET%=-1 THEN NO_BE
TS% = NO_BETS%+1 ELSE BETS_PLA
CED%=BETS_PLACED%+1
  370 IF A$(NUM%,2) = "B" THEN
 BLACK%=BLACK%+1
  380 IF A$(NUM%,2) = "R" THEN
 RED%=RED%+1
  390 IF A$(NUM%,3) = "1" THEN
 COL1%=COL1%+1
  400 IF A$(NUM%,3) = "2" THEN
 COL2%=COL2%+1
  410 IF A$(NUM%,3) = "3" THEN
 COL3%=COL3%+1
  420 IF A$(NUM%,4) = "1" THEN
 DOZ1%=DOZ1%+1
  430 IF A$(NUM%,4) = "2" THEN
 DOZ2%=DOZ2%+1
  440 IF A$(NUM%,4) = "3" THEN
 DOZ3%=DOZ3%+1
  450 NEXT CNT%
  460 ENDPROC
  470 DEF PROCCHOOSEBET
  480 IF RED% > BLACK% THEN BE
T$(1)="B":GOTO 500
  490 IF BLACK%>RED% THEN BET$
(1)="R" ELSE BET$(1)=""
  500 IF COL1% < COL2% AND COL
1% < COL3% THEN BET$(2)="1":GO
TO 530
  510 IF COL2% < COL1% AND COL
2% < COL3% THEN BET$(2)="2":GO
TO 530
  520 IF COL3% < COL1% AND COL
3% < COL2% THEN BET$(2)="3" EL
SE BET$(2) =""
  530 IF DOZ1% < DOZ2% AND DOZ
1% < DOZ3% THEN BET$(3)="1":GO
TO 560
  540 IF DOZ2% < DOZ1% AND DOZ
2% < DOZ3% THEN BET$(3)="2":GO
TO 560
  550 IF DOZ3% < DOZ1% AND DOZ
3% < DOZ2% THEN BET$(3)="3" EL
SE BET$(3)=""
  560 FOR I=1 TO 36
  570 IF BET$(1) ="" OR BET$(2
)="" OR BET$(3)="" THEN I=36
  580 IF A$(I,2) = BET$(1) AND
 A$(I,3) = BET$(2) AND A$(I,4)
 = BET$(3) THEN NUMBET%= VAL(A
$(I,1)) ELSE NUMBET%=-1
  590 IF NUMBET%<>-1 THEN I=36
  600 NEXT I
  610 ENDPROC
  620 DEF PROCPRINT
  630 CLS:PRINT TAB(1,3)"Reds
                 =";RED%
  640PRINT TAB(1,4)"Blacks
           =";BLACK%
  650 PRINT TAB(1,6)"First col
s           =";COL1%
  660 PRINT TAB(1,7)"Second co
lumn        =";COL2%
  670 PRINT TAB(1,8)"Third col
umn         =";COL3%
  680 PRINT TAB(1,10)"First do
zen          =";DOZ1%
  690 PRINT TAB(1,11)"Second d
ozen         =";DOZ2%
  700 PRINT TAB(1,12)"Third do
zen          =";DOZ3%
  710 PRINT TAB(1,14)"Bets pla
ced          =";BETS_PLACED%
  720 PRINT TAB(1,15)"Number o
f times":PRINT TAB(1,16)"no be
ts were placed  =";NO_BETS%
  730 PRINT TAB(1,18)"Money wo
n/lost       =";MONEY%
  740 PRINT TAB(1,20)"Wins
                 =";WINS%
  750 PRINT TAB(1,21)"Losses
                 =";LOSSES%
  760 PROCNEXTSCREEN
  770 ENDPROC
  780 DEF PROCPRINTSTATS
  790 CLS:P=3
  800 FOR K=0 TO 36 STEP 2
  810 P=P+1
  820 PRINT TAB(3,2);"STATISTI
CS OF NUMBERS THAT APPEARED"
  830 PRINT TAB(3,3);"========
== == ======= ==== ========"
  840 PRINT TAB(3,P);K;" =";ST
ATS%(K);" shows";:IF K+1=37 TH
EN GOTO 850 ELSE:PRINT TAB(23,
P);K+1;" =";STATS%(K+1);" show
s";
  850 NEXT K
  860 PROCNEXTSCREEN
  870 ENDPROC
  880 DEF PROCPRINTSTATS1
  890 CLS:P=3
  900 FOR K=1 TO 36 STEP 2
  910 P=P+1
  920PRINT TAB(3,2);"STATISTIC
S OF NUMBERS THAT WERE BET"
  930 PRINT TAB(3,3);"========
== == ======= ==== ==== ==="
  940 PRINT TAB(3,P);K;" =";ST
ATS1%(K);" bets";TAB(23,P);K+1
;" =";STATS1%(K+1);" bets";
  950 NEXT K
  960 PROCPLAYAGAIN
  970 ENDPROC
  980 DEF PROCNEXTSCREEN
  990 PRINT TAB(5,24);"Press a
ny key to continue";:A$=GET$
 1000 ENDPROC
 1010 DEF PROCPLAYAGAIN
 1020 PRINT TAB(3,23);"Press F
 to finish playing";TAB(3,24);
"Any other key to play again";
 1030 A$=GET$
 1040 ENDPROC
 1050 DATA 0,0,0,0
 1060 DATA 1,R,1,1
 1070 DATA 2,B,2,1
 1080 DATA 3,R,3,1
 1090 DATA 4,B,1,1
 1100 DATA 5,R,2,1
 1110 DATA 6,B,3,1
 1120 DATA 7,R,1,1
 1130 DATA 8,B,2,1
 1140 DATA 9,R,3,1
 1150 DATA 10,B,1,1
 1160 DATA 11,B,2,1
 1170 DATA 12,R,3,1
 1180 DATA 13,B,1,2
 1190 DATA 14,R,2,2
 1200 DATA 15,B,3,2
 1210 DATA 16,R,1,2
 1220 DATA 17,B,2,2
 1230 DATA 18,R,3,2
 1240 DATA 19,R,1,2
 1250 DATA 20,B,2,2
 1260 DATA 21,R,3,2
 1270 DATA 22,B,1,2
 1280 DATA 23,R,2,2
 1290 DATA 24,B,3,2
 1300 DATA 25,R,1,3
 1310 DATA 26,B,2,3
 1320 DATA 27,R,3,3
 1330 DATA 28,B,1,3
 1340 DATA 29,B,2,3
 1350 DATA 30,R,3,3
 1360 DATA 31,B,1,3
 1370 DATA 32,R,2,3
 1380 DATA 33,B,3,3
 1390 DATA 34,R,1,3
 1400 DATA 35,B,2,3
 1410 DATA 36,R,3,3
>
>
```

△ ...a fax machine and more

With the ever increasing popularity of FAX machines this form of document communication is set to replace conventional postal deliveries with a fast, reliable, strike free, electronic mail service.

FAX PACK brings this world of facsimile document transfer to the Archimedes. By combining the facilities of a FAX machine with the power and flexibility of a computer, FAX PACK offers considerable benefits over conventional FAX systems.

FAX PACK basically allows any document, be it printed text or graphics, or an electronic document such as a word processor file, to be sent to FAX machines anywhere in the world, in seconds. This is done by scanning (digitising) the document and then sending it digitally over a normal phone line to the receiving FAX machine which re-constructs the image and then prints it.

△ FAX • P A C K •

THE HARDWARE

The basic FAX PACK consists of a modem podule that plugs into any Archimedes computer, and the software to drive it. A variety of options are available such as scanners and power switching boxes.

The podule has connections for a scanner and power switching box (see below) and a conventional telephone line. An adapter is provided allowing a conventional phone to be paralleled with FAX PACK so that only one telephone line is required for both FAX and conventional use. However if a lot of FAX mail is going to be sent/received then a separate dedicated line is advisable.

Scanner & Sheet Feeder

Unlike many normal FAX machines the hardware also provides both auto-answer and auto-dial facilities making it convenient and allowing completely automatic operation without human intervention.

THE SOFTWARE

As part of FAX PACK this not only provides all the basic mechanisms for communicating with FAX machines but also includes high level WIMP based facilities for viewing FAXes on screen within a window, where they can be pixel edited, scaled, cropped,printed, etc.

This WIMP based software is simplicity itself to use so FAX PACK can be used in the office by staff with little or no computer experience. Of course unlike any conventional FAX machine FAXes can be viewed on screen, or filed away on disc for future reference without ever getting onto paper.

The software also allows text, word processed files, even graphics, to be automatically converted to a suitable FAX format for sending to other FAX machines. The paperless office becomes closer to reality since it is now possible to write articles, documents or letters and then send these directly to remote machines without involving paper.

However facilities are also included for printing FAXes to a range of 9 and 24 pin dot matrix, inkjet and laser printers.

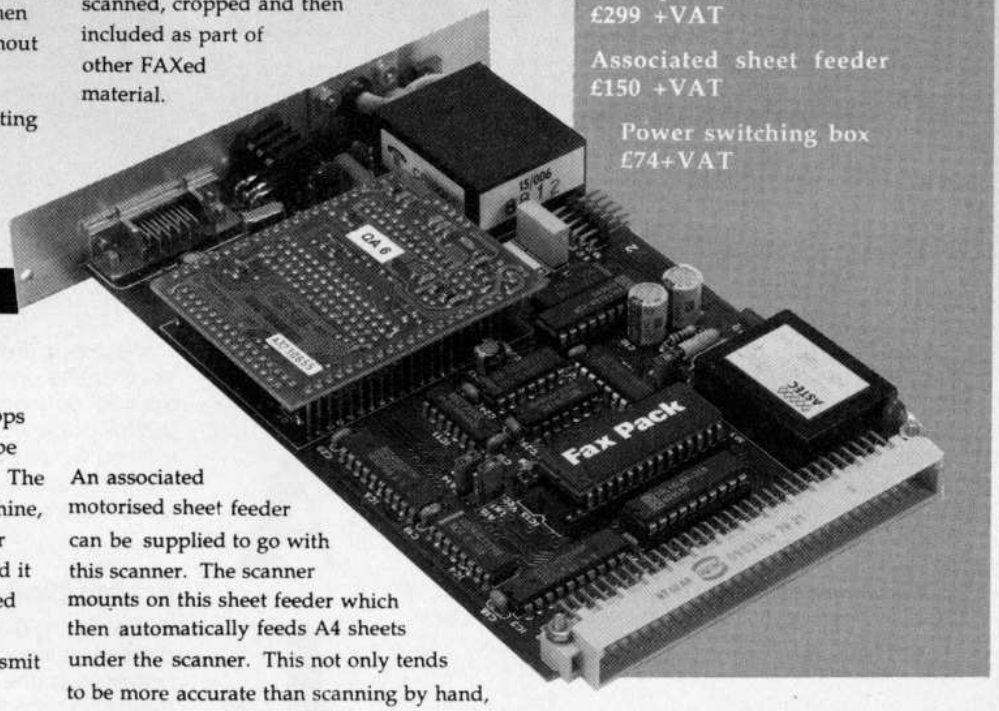
SUPER FAST MODEM

The FAX podule actually consists of a 9600 bps auto-answer, auto-dial modem, and so can be used for much more than just FAX transfer. The software can detect the type of remote machine, and if it finds a similarly equipped computer (rather than a FAX machine) at the other end it can then transfer ANY file fully error checked and glitch free. And by using some very advanced transmission protocols it can transmit data 4 times faster than most conventional modems on normal telephone lines.

THE SCANNER

In order to send printed material it is necessary to digitise the page. An optional hand-held, A4 width, 200 dpi scanner can connect to the FAX podule. Being hand-held it is not only supremely compact, but it can digitise complete A4 pages, or pages from books or other awkward shaped documents.

Of course images scanned in this fashion are not only useful for FAX purposes but also for inclusion in word processor or desk top publishing programs. FAX PACK software allows company logos and signatures to be scanned, cropped and then included as part of other FAXed material.



An associated motorised sheet feeder can be supplied to go with this scanner. The scanner mounts on this sheet feeder which then automatically feeds A4 sheets under the scanner. This not only tends to be more accurate than scanning by hand, but is also more convenient.

AUTOMATIC POWER SWITCH

This external power switching box can automatically switch the computer on in order to answer incoming FAXes. The FAX podule can then answer the phone, receive the FAX and file it to disc, and then switch the computer off again. The computer can therefore be switched off and left completely unattended for very long periods of time.

GUARANTEE

Not only do we provide a one year guarantee for the product, but also a 28 day money back no quibble guarantee. Owners can also receive free software updates as enhanced or new facilities are made available.

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£499 +VAT

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Des Thomas

DTP SPECIAL

FRONT PAGE

Newman College, the "home" of MAPE, has come up with some very interesting programs since it entered the arena of IT in initial and extended teacher training – *Picture Builder, Grass, Grasshopper* to name but a few. Perhaps the best known in the primary field are *Front Page* and *Front Page Extra*, two introductory newspaper packages which appeared on MAPE Tapes One & Two – freebies to members of MAPE! They've been licenced by most Authorities, so *Front Page Extra*, in particular, is well-used nationwide.

Recognising the fact that DTP is one of the areas that really seems to have caught the imagination of teachers, Roger Keeling and his colleagues have produced a new *Special Edition*, which builds on the simple format that made the earlier versions so popular with children and teachers alike. However, *Special Edition* has been designed for the Master and Compact, so it extends the scope offered and all from one "working screen" with hardly a whir of a disc drive to be heard.

Getting Started

If you've used *Front Page Extra*, you can start using this program successfully without concerning yourself about the additional facilities. All you need to do is autoboot the disk and select "Start a new page". This offers a new menu of nine different page layouts: the first three options are "fixed" full A4 page versions of the page layout available in FPX, while the second three are half page versions of the same. Unlike FPX, the latter are printed out in normal fashion rather than the landscape format. No changes to the overall page plans are possible, so at this stage you can concentrate on the material being developed for the newspapers. Even if you've never even heard of FPX, all you really need to do is type a few words in each box and you'll have little difficulty in following what's happening – the system is that user-friendly!

New Features

The screen display is clear and the information shown is concise but precise. The top two-thirds of the screen is the text window, within which the page is scrolled up/down, while the bottom third displays some icons. These indicate the additional facilities available by means of the function keys or a mouse – pressing f1 or a mouse button switches between "text" and "frame" modes, which I'll return to.

While default font styles and sizes have been set for the pages mentioned above, it is possible to change them and the way in which the text is justified within the boxes – these are the areas set-up on the screen to give the lay-out of the page. So, having created your first page and saved it, you can reload it and play with it to your heart's content. If you're happier using a page already set up for you, then there's a full page sample plus Chapter Two of the manual to guide you through the additional features.

If you can resist the temptation, it's worth checking some of the other options available from the main menu before going on to this second stage, particularly before you try using a printer. The program can be set up to be used with the full range of Epson printers and their compatibles, including the LQ range of 24 pin printers, and the Walters 2000 – didn't realise there were any still around! There are four printout options: full size, draft (same time taken, little difference in quality), mini page (very useful for first draft as it only takes about three minutes per page), and a dense version for the finished article (approx. 17 minutes printing time). The Print Page option allows up to nine copies of ten different pages to be printed in one batch, which can be quite useful to set up for a lunchtime session.

All this is available through a delightfully simple menu system. I mentioned earlier that on FPX the page was printed out in landscape fashion, ie along the length of the paper. While this didn't give a very good "tabloid" newspaper impression, to have a half page POSTER page which could be printed out in this manner would be very useful – thinking of all those programmes, small booklets, etc. As I've said before, we're never satisfied!

Frame Mode

It's possible to add any of the eight different frame styles – to surround a drawing, perhaps, which will be added later (there is no graphic facility in FPSE), and these can be added even to the prepared pages. By using the function keys (or mouse) the box can be enlarged, reduced or moved around, complete with text, or deleted.

However, this mode really comes into its own if you try the Poster page. This is the blank page option which allows you to design your own page layout, and is where FPSE moves from a newspaper simulation to a desk-top publishing package, for not only does it give the freedom to plan your own newspaper layout, it can be used to design virtually anything – a simple ticket, a poster (this was the first use I put it to), programmes, numerous forms required for administration, etc, etc.

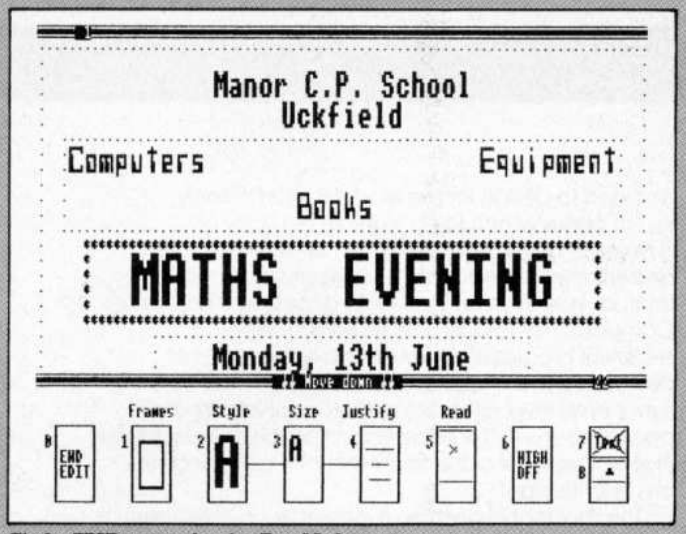

Fig.1a. FPSE screen showing Text Mode.

One of the pleasing things about this option is the facility to set up the page as required with font defaults, eg the acrostic poem in Fig.4b, and save the page outline. This can be reloaded – as the other "fixed" pages – and used by the whole class if necessary (well, almost, because you can save a maximum of 21 pages on a disc), because individual's pages can be saved under other headings. The other two page options are large and small lists. The former divides the page into a four by four grid, while the latter uses a four by eight grid. A copy facility would be quite useful here – there are a couple of function key blanks available in the frame mode!

At first I was disappointed that it wasn't possible to join the boxes to make an irregular shape as one might want on a newspaper front page, but the fact that the dotted box isn't printed out makes this a relatively minor irritation as far as layout is concerned. While there is a line count available at the top and bottom of the text window, the only help given in positioning the cursor horizontally is the use of the CTRL key in conjunction with the left/right arrow to move the cursor across the screen in steps of 10 characters.

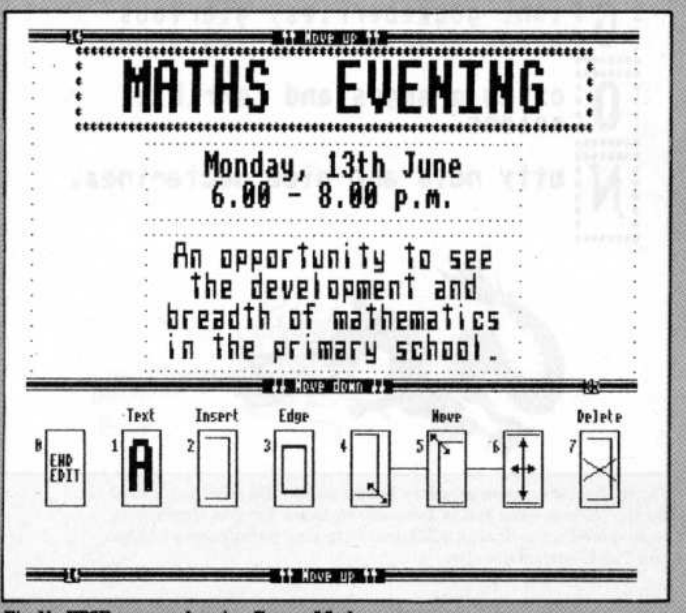

Fig.1b. FPSE screen showing Frame Mode.

Left justifica-tion - the normal typist style	If you are designing a news-paper then it is usual to have your text fully justified. However, beware large gaps if your columns are too narrow!	It is possible to change your font style every word if you really must!	A copy option would have been useful!
Right justification occasionally useful!	Centre justified text is ideal for posters	Just a few of the options available with Front Page Special Edition.	A copy option would have been useful!
Data The data font is used with computer text	Aladdin Mysteries of the East	Bold is useful for emphasis-ing words	Egyptian the font of the pyramids
Advertise in this space. Only £5000!!	System the font built into the micro	Fine is similar but much finer	That is all

Fig.2. Small list layout illustrating the fonts and various justifications possible in FPSE.

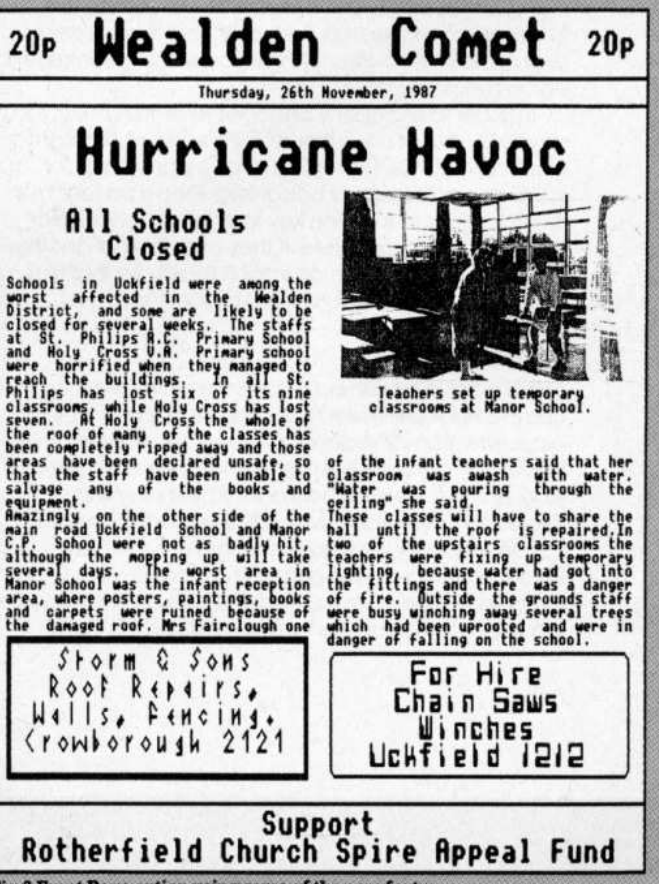
20p Wealden Comet 20p
Thursday, 26th November, 1987
Hurricane Havoc
All Schools Closed
Schools in Uckfield were among the worst affected in the Wealden District, and some are likely to be closed for several weeks. The staffs at St. Philips R.C. Primary School and Holy Cross V.A. Primary school were horrified when they managed to reach the buildings. In all St. Philips has lost six of its nine classrooms, while Holy Cross has lost seven. At Holy Cross the whole of the roof of many of the classes has been completely ripped away and those areas have been declared unsafe, so that the staff have been unable to salvage any of the books and equipment.
Amazingly on the other side of the main road Uckfield School and Manor C.P. School were not as badly hit, although the mopping up will take several days. The worst area in Manor School was the infant reception area, where posters, paintings, books and carpets were ruined because of the damaged roof. Mrs Fairclough one of the infant teachers said that her classroom was awash with water. "Water was pouring through the ceiling" she said.
These classes will have to share the hall until the roof is repaired. In two of the upstairs classrooms the teachers were fixing up temporary lighting, because water had got into the fittings and there was a danger of fire. Outside the grounds staff were busy winching away several trees which had been uprooted and were in danger of falling on the school.
Teachers set up temporary classrooms at Manor School.
Storm & Sons Roof Repairs, Walls, Fencing, Crowborough 2121
For Hire Chain Saws Winches Uckfield 1212
Support Rotherfield Church Spire Appeal Fund

Fig.3 Front Page option using some of the new features.

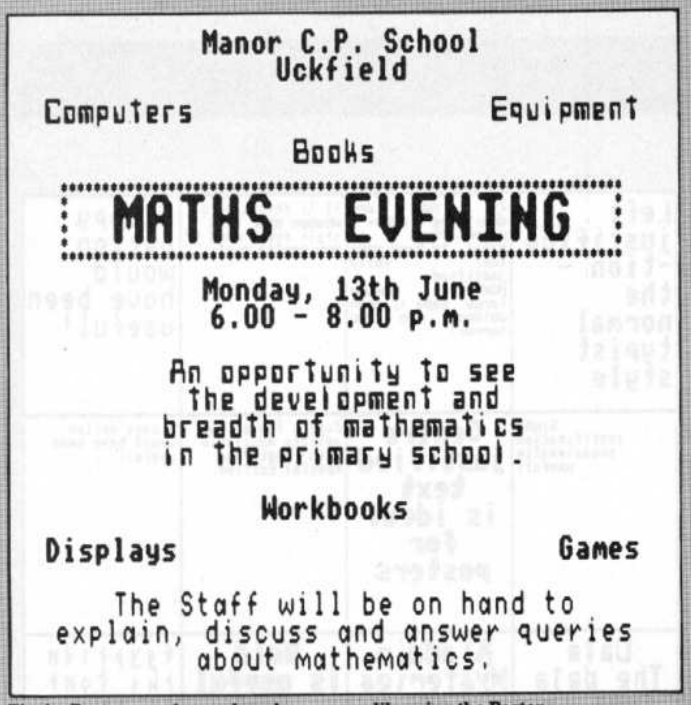

Fig.4a. Posters can be produced very speedily using the Poster page and centre justification.

Text Mode

There are six attractive fonts available in three different sizes. Each box gives a mini-wordprocessing environment – what you see is literally what you get. While you're unlikely to want to change font style or size every other word – too many changes can be counter-productive – in most instances it would be possible. The option I particularly appreciated in this mode was that which permits text to be justified in four different styles: right, left, full, or centre. The first time the last mentioned appears on the screen you'll probably find strange, as the characters start in the centre of the text area and spread outwards. In fact this is a very useful and timesaving option if you want to centre text, eg as in posters.

In order to make any changes to areas of text, it's a simple matter of using the <COPY> key to highlight a word or line, <COPY + CTRL> for a paragraph, or <COPY + SHIFT> for a box of text. Then it's a touch on the appropriate function key to change font style or size, justification, or delete. If they ever think of another upgrade, I'd like to see an import facility, so that files could be brought in from word processors.

Conclusions

At this point in time it would be unfair to make direct comparisons between FPSE and the opposition, ie *Typesetter* from Sherston, because that was designed to work on a Model B, while this has been designed to work on a Master. I've had a very brief play with Granada's *Dead Line*, which has a Model B/Master option, but early impressions of that are far from favourable. From a programming point of view I imagine designing for a Master allows an even greater removal of the shackles than when programmers decided to design for the Model B with DFS only.

I'm certainly not going to throw my copy of *Typesetter* away, because it's an excellent program and with two fairly traditional fonts gives a first class printout. However, for those with access to a Master or Compact, *Front Page Special Edition* offers an excellent progression through the early stages of newspaper publications and definitely serves as a super entry level program to more sophisticated dtp packages – with the exception of graphics, I would say that it offers most of the facilities that most youngsters are likely to want.

The fact that everything is available on one screen is a distinct advantage; that all the facilities are available without accessing the disc makes it fast to operate – anyone with reasonable keyboard dexterity will need to be patient with the medium and large fonts! The ability to create a multi-font page at these levels plus the highlighting options are big bonuses; while, lastly, if you work for an Authority that takes out a licence you should be able to get a copy for little more than a fiver, I imagine. For a program of this quality that can't be bad.

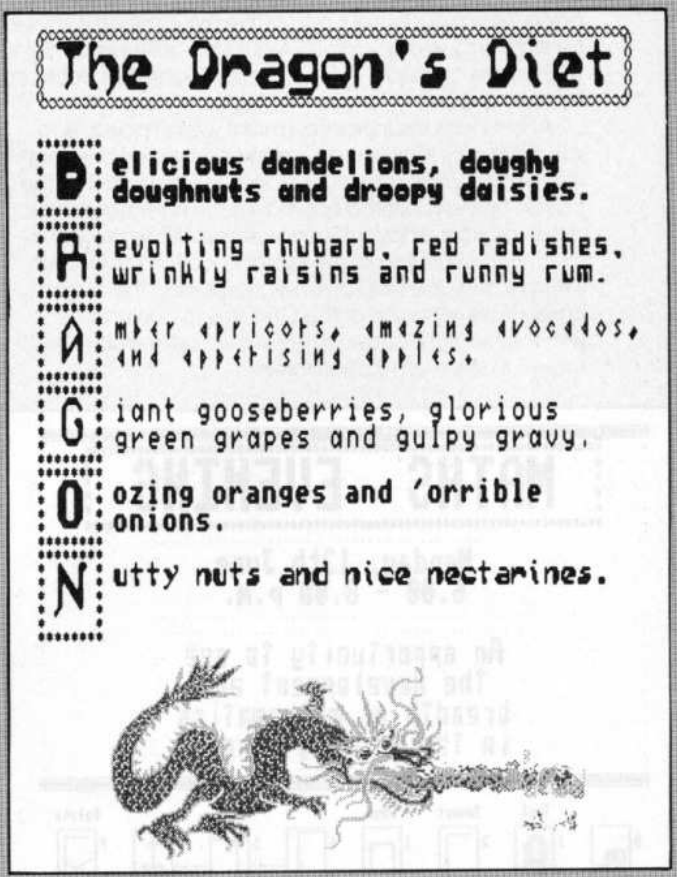
The Dragon's Diet
Delicious dandelions, doughy doughnuts and droopy daisies.
Revolting rhubarb, red radishes, wrinkly raisins and runny rum.
Amber apricots, amazing avocados, and appetising apples.
Giant gooseberries, glorious green grapes and gulpy gravy.
Oozing oranges and 'orrible onions.
Nutty nuts and nice nectarines.

Fig.4b. Acrostic poem using the poster page – different fonts used for the various lines just to demonstrate them! Dragon illustration reproduced using *Snatch* (4Mation) with kind permission of Abbas and The Electronic Studio.

Factfile

- **Front Page Special Edition is available from Newman Software Ltd, Newman College, Genners Lane, Bartley Green, Birmingham B32 3NT ☎ 021 476 1181. Price £25.00 for individual copies.**

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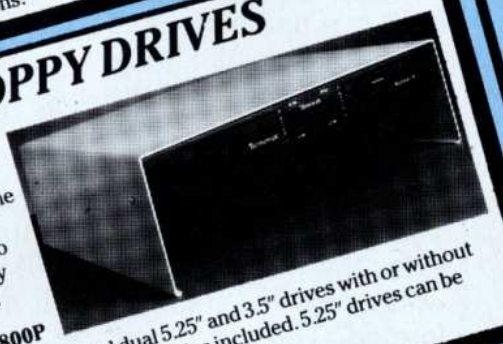

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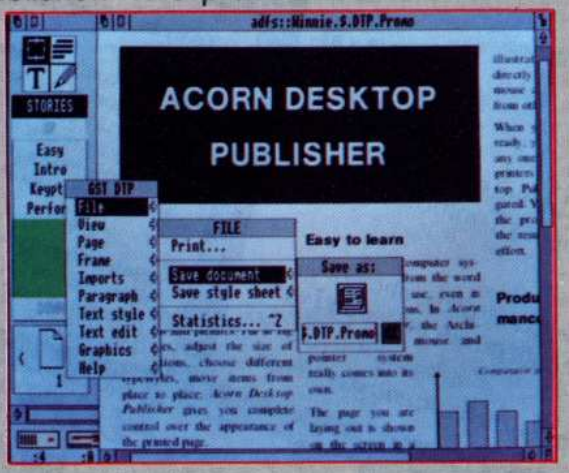
AB/1

Acorn Desktop Publisher

Acorn Desktop Publisher will be one of the first RISC OS dependent software packages to be released. *Bruce Smith* recently named Desktop Publishing Journalist of the Year, describes what we can expect.

The term Desktop Publishing may be new to many A&B readers but it is one that will become increasingly more common as we progress into 1989. With the launch of the Archimedes new Operating System - RISC OS - will come several new Acornsoft software application packages one of which will be Acorn Desktop Publisher. This preview of Acorn Desktop Publisher will introduce many of the features of the product and outline the type of things that it is going to be able to do and whom it will suit.



Desktop Publishing as such is a name given to the process of designing and laying out the pages of a letter, circular, magazine, manual or book using a computer coupled with a high quality printer. The desktop publishing (DTP) software provides the medium for this, but it is not a tool with which the information it manipulates is formed. Thus text must be prepared before hand in a wordprocessor, graphics in a suitable art package and so forth. In fact the term DTP is not a particularly good one and Personal Publishing is a far superior term.

DTP packages as such already proliferate on computers such as PCs, and Macintoshes and so forth, indeed the books we produce at Dabs Press are all prime examples of what can be achieved with desktop publishing, and although they have all been produced using a Mac, similar results will be achievable with Acorn Desktop Publisher!

If you have been watching the news pages then you may already be aware that Acorn DTP is based on Timeworks Desktop Publisher which has been available on the PC for just about a year. The Acorn enhanced version which makes full use of the multitasking capabilities of RISC OS will require a 1Mb Archie with disc drive. While it will be possible to use the software from a single disc-based system, two drives are really almost a necessity while a hard disc will enhance performance of the software many fold. In fact use on a single drive system will probably prove difficult n ot least becuase fonts will have to be loaded in from disc as required and if you use several fonts in a publication.... My own view that a 2Mb, hard disc Archimedes will be needed to exploit the full potential of RISC OS anyway.

A Matter of Styles

In general, desktop publishing software can be broadly divided into two distinct categories - the page processor and the document processor, they differ from one another in the way in which they manipulate text - a process called pagination.

As the name implies the page processor is geared towards producing short documents, perhaps single sheet newsletters, flyers and newspapers - basically anywhere there may be a number of columns of various shapes and sizes on the page or pages.

This preview published using Timeworks DTP on my Dell System 200 and printed on an Apple Laserwriter II NT.

Pre-prepared text is poured into columns. Over matter text is not automatically drained into the next column, instead it must be picked-up and placed there.

Type attributes – that is the size, font and style of the text – are then applied by first selecting the text and then assigning attributes by making a series of choices from menus and ensuing dialogue boxes. Each new typestyle has to be applied to each letter, word, sentence or paragraph as required. This and the column flowing are potentially time consuming processes. The early versions of *Fleet Street Editor* for the BBC micro took this approach.

A document processor is designed to handle large volumes of text, although it can cope with single and multiple sheets quite happily. As with page processors, master pages can be defined to form templates into which text and graphics are dropped. With a document processor when text is imported into a column it can be made to flow right through the document, adding new pages and paginating the text according to a pre-defined set of rules.

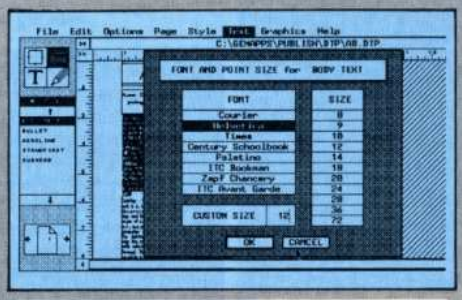
Document processors use paragraph style sheets, these are named formats which contain text attributes. When a style is 'tagged' to a section of text it then takes on the attributes of that particular style. Thus a style called 'Small Bold' can be defined and when tagged to a section of text it will become small and bold in nature (assuming those where the attributes assigned to it!). A library of styles can be built up in this way and loaded as part of the master pages. The action of tagging a style is quite simple – place the cursor anywhere in the paragraph and select the style from a style menu. *ADTP* falls into the document processor category, but also includes a number of features normally only associated with page processors.

Creating paragraph styles is a simple process and just requires standard dialogue boxes to be completed as they are presented on-screen.

At first sight the use of such style sheets may seem to be a very cumbersome way to approach assigning type attributes, but far from it – it is a very powerful tool. Once a style has be defined it can be edited and changed at any time. Thus if you wish to make the size of the text which forms, say the main body copy, you can do so simply by editing the associated style sheet accordingly. All text associated with the defined style will then be re-paginated and fitted into the pages accordingly!

ADTP uses a WYSIWYG (wiz-e-wig) display – a piece of DTP jargon which is an acronym for **W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **G**et. This means that the representation of the pages on the screen is exactly (well, near enough) what is printed out. Thus text, columns, pictures and so forth are shown to scale. In fact as the resolution between screen and printer are often quite different a better anronym would be WYSIMOLWYG (wiz-e-mol-wig) **W**hat **Y**ou **S**ee **I**s **M**ore **O**r **L**ess **W**hat **Y**ou **G**et!

As mentioned above text and graphics must be prepared beforehand and using the various file interchange formats outlined by Acorn and in-built text filters text created in, say 1st Word Plus, will be able to be loaded into *ADTP* and retain all the type attributes assigned to it. So text set as bold in 1st Word Plus will be displayed as such in *ADTP*.



Styles are created by filling in simple dialogue boxes to simplify the whole task.

ADTP will also support pre-tagging of text, which will make it possible to assign styles to text at the wordprocessing stage. This is achieved by embedding style names in the text bounded by chevrons, ie, < and >. For instance if the tag, <Headline> was embedded then when the text is loaded into *ADTP* it will take on the attributes of the style called Headline assuming of course that the Headline style exists!

Graphics and images will also be accepted from various packages including those created with ArcDraw (supplied with RISC OS), AutoSketch, and Artisan.

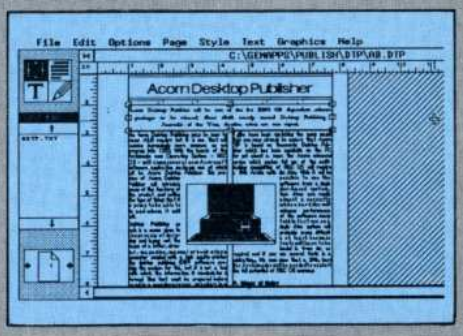
Text and graphics are loaded into *ADTP* (the term 'placed' is more commonly used for this process) by 'dropping' them into frames which have been pre-defined on the page. These are created using a special frame drawing icon and once in position text and graphics can be placed into them using simple menu options. Frames are also used to create columns and a page may contain up to nine of these. By selecting a series of frames using a menu option they can be linked together so that text will flow from the first frame, to the second, to the third and so on. This is useful for creating both columns, book pages and complicated newsletter layouts. If a frame is placed within a frame and these are not linked then the text will simply flow around the intruding frame.

ADTP is not a wordprocessor, but it does support rudimentary editing facilities, such as copy, paste and delete. It also includes a search and replace, not normally found in other DTP packages.

In addition to style sheets master pages are supported. A master page is a template from which new pages are created. There may be two master pages, one for left hand pages and one for right. They may contain text frames for immediate use – this is ideal for publications where the page format is unlikely to change very much – books are a prime example.

ADTP will support a wide range of typographical facilities. At the time of writing the number of fonts supplied with the standard package has yet to be decided upon, those included so far include Trinity, Homerton and Corpus in medium, medium italic, bold and bold italic. These three fonts relate to Times, Helvetica and Courier look alikes the names of which cannot be used for copyright reasons. A Headline and Symbol font will also be included.

Both kerning (the moving together of



ADTP uses a frame based approach. The fame holding the standfirst is clearly marked by the eight small retangles which can be dragged to enlarge and re-size it at any time.

two letters) and hyphenation are fully supported the former being available as a manual option. Hyphenation is implemented along automatic lines adhering to a pre-defined set of rules in the software. An exceptions dictionary exists that can be edited by the user to over ride these rules if so required.

Unlike many other DTP packages *ADTP* provides a good range of graphics tools with which a variety of lines to various thicknesses, free-form curves, circles, boxes, and ellipses to name but a few can be drawn. Also incorporated is a bit-map editor which allows graphic artwork to be fine tuned and cleaned up once loaded. Imported graphics may also be scaled and cropped if required.

Output can be to virtually every type of output device including 9-pin (Epson FX80/FX800 range) and 24-pin (Epson LQ850 range) dot matrix printers. In addition the Integrex colour printer is supported along with the Epson GQ3500 and HP LaserJet 2 laser printers. *ADTP* will also incorporate a PostScript driver which in itself will allow printing to Postscript devices such as the Apple LaserWriter and a wide range of professional phototypesetting devices that are PostScript compatible.

Measuring Up But how will *ADTP* compare with similar software currently available on other micros? The answer is very well indeed. While the product lacks the typographical finesse of products such as Xerox Ventura Publisher and PageMaker on the PC it provides just about all the facilities that would be required by the home, educational and small business user.

The user interface is of a much higher quality than one would expect and when combined with the collaborative multi-tasking of RISC OS it becomes a very powerful package. For instance, text could be created and edited in one window running, say 1st Word Plus, and then saved directly into a page frame in another window where *ADTP* is running.

The key to desktop publishing is space and speed as the pagination process which forms the heart of DTP is all about memory manipulation. A 1Mb (preferably 2Mb) micro that just happens to be the fastest in the world would look to an ideal choice. And at a predicted price in the region of £150 *ADTP* should be placed relatively high on the RISC OS user's shopping list.

ARCHIMEDES COMMANDER

– take control of your machine

It's easy with Arc Commander, the mouse controlled, menu driven file and applications manager.
This is how easy...

DISC DISPLAY

- Note the highlighted filenames and the intelligent selection of available commands.
- Full information about the mouse selected file appears in the top righthand corner.
- Context sensitive help messages appear in the bottom line at all times.
- Change directory in two clicks.

CONFIGURATION DISPLAY

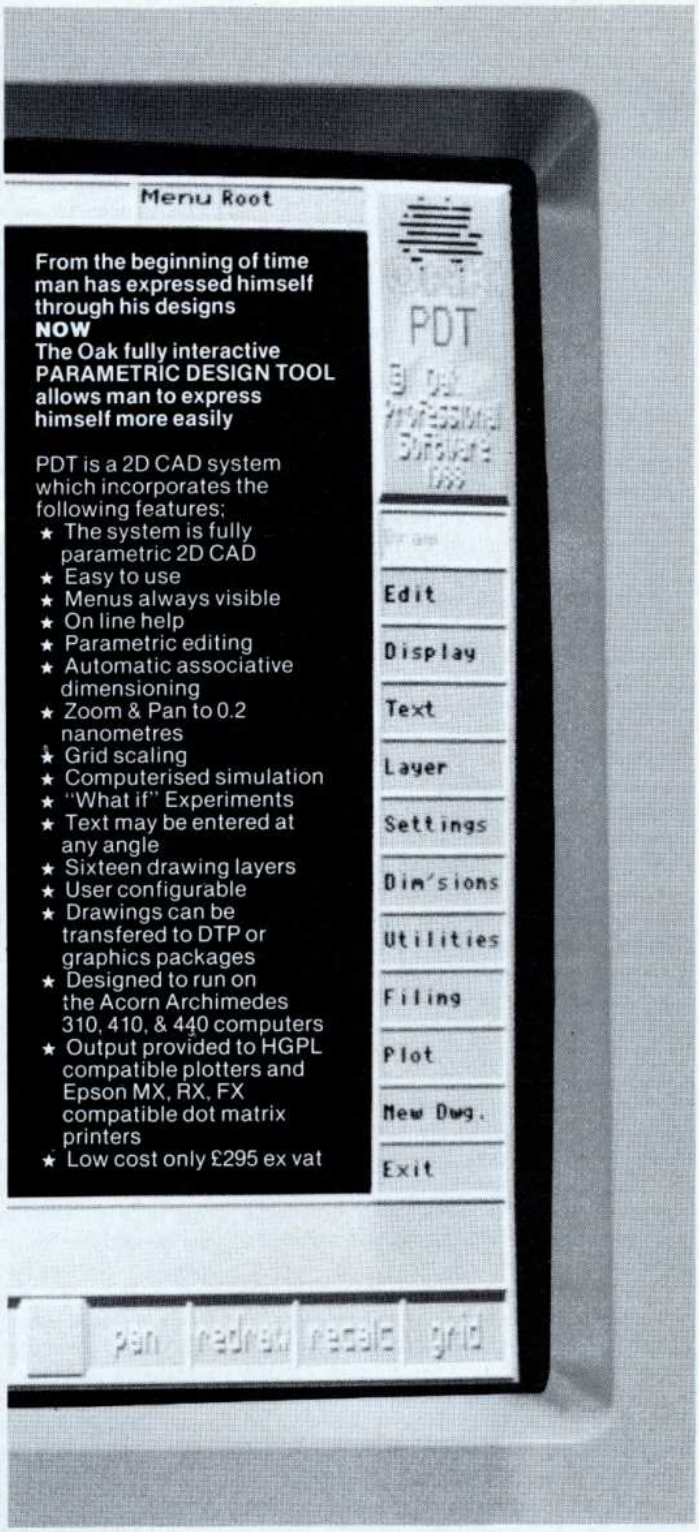
- All configurable options are displayed.
- Sensible descriptions are used eg Screen-size 160K, Baud rate 1200.
- An explanation of the configuration option is given with available mouse button presses shown on screen.

MODULE DISPLAY

- Information about modules includes whether they are in ROM, RAM or Podule.
- A full breakdown of each module, including all commands and associated syntax can be displayed.
- Modules can be turned on and off and a default module chosen. Of course Arc Commander makes the best default front end!

INSTALLATION

- Arc Commander is installed as a module. Programs activated from Arc Commander will return to it.
- Arc Commander will return to the environment from which it was called eg Desktop, Twin, BASIC.
- Order now through our Services page.


Menu Root
From the beginning of time man has expressed himself through his designs
NOW
The Oak fully interactive PARAMETRIC DESIGN TOOL allows man to express himself more easily
PDT is a 2D CAD system which incorporates the following features;
★ The system is fully parametric 2D CAD
★ Easy to use
★ Menus always visible
★ On line help
★ Parametric editing
★ Automatic associative dimensioning
★ Zoom & Pan to 0.2 nanometres
★ Grid scaling
★ Computerised simulation
★ "What if" Experiments
★ Text may be entered at any angle
★ Sixteen drawing layers
★ User configurable
★ Drawings can be transfered to DTP or graphics packages
★ Designed to run on the Acorn Archimedes 310, 410, & 440 computers
★ Output provided to HGPL compatible plotters and Epson MX, RX, FX compatible dot matrix printers
★ Low cost only £295 ex vat
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Text
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Product	Price	Annual systems maintenance	Telephone hot line support	VAT	Total Price
PDT	295.00	45.00	25.00	54.75	419.75
PDT	295.00	45.00		51.00	391.00
PDT	295.00		25.00	48.00	368.00
PDT	295.00			44.25	339.25

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A1 FAX SHEET

Faxfile guide to DTP jargon

Ascender
part of a lower case character which rises above the "x height" (the height of an x)

Attribute
a style or effect applied to a piece of text

Banner
the main headline of a story/article

Base line
invisible line upon which the text rests

Binding margin
depending on the binding process, space may have to be left on the inside of the page

Bleed
to place artwork so that it runs over the edge of the page

Blocking
text displayed as a block of grey

Body text
the main text

Bullet
block or blob used in front of text in lists or as a highlight

Byeline
author's name

Caption
explanatory text added to a picture

Clip Art
ready-drawn art available on disc

Clipboard
name given to a temporary store where text or graphics are held ready for pasting in to a page

Column snap
a feature which forces text/graphics to predefined column positions

Column width
the distance over which text is positioned on the page

Control codes
invisible combinations of characters which trigger screen and/or printer effects

Copy
the jargon word for text to be typeset

Crop
cutting away parts of a picture to give a new view

Crop marks
marks on artwork or film to mark the boundary of the page

Cross head
subheading in text column (also sidehead)

Cut
shorten an article by cutting lines of text

Descender
part of a character which descends below the base line

Digitise
convert a video picture, from VCR or camera, into a pixel-based image suitable for digital manipulation

DPI
dots per inch, a way of expressing the dot resolution of a printer

Drop capital
initial letter set in a larger point size than the following copy

Image
a graphic on screen, often scanned or digitised

Impact
printer type, usually dot matrix in the context of DTP but could be daisywheel

Indent
blank space before the beginning of text/graphics, most often at the beginning of a paragraph

Justification
vertical alignment of text on both left and/or right-hand edges of a column

Kerning
adjusting the width between characters

Landscape
a page or document where the width is greater than the height, eg printing "landscape" prints longways on an A4 sheet of paper

Layout
the arrangement of elements such as text, artwork and photographs on a page

Leading
the distance between two lines of type

Make up
Laying down the galleys and illustrations (also paste up)

Mechanical
finished piece of artwork, a bromide or PMT

OCR
optical character recognition. Text can be scanned and re-interpreted for the computer screen

Orphan
a short line at the top of a column or page of text

Outdent
text starting outside the left-hand column

Overmatter
unused copy after design

Pagination
numbering the pages

PDL
page description language. A computer language which controls the laser printing hardware directly

Pica
a type unit of 12 points. There are six picas (72 points) to the inch

Pixel
a single picture element (one of many dots which make up a screen picture)

Proportional spacing
each character is given appropriate spacing

Portrait
a page or document where the height is greater than the width, eg normal orientation for an A4 sheet of paper

Postscript
page description language by Adobe. It drives laser and type

Ragged
opposite of justified. Text moves onto the next line when a further word cannot be fitted into the width of the column

Em – Pica
Em space is the width of M in the relevant point size
En space is similary the width of N

EPS
Encapsulated Postscript

Font
a family of type with associated styles (bold, italic etc)

Footer
wordprocessing term for an item of text to appear at the bottom of a page, often repetitively

Footnote
explanatory note associated with body text by a number reference

Galley
a single column width of typeset text

Greeking
meaningless text used to indicate position only – often Latin not Greek!

Grey levels
tones of black, usually expressed in percentages (black is 100%)

Grid
a design laid out onto a grid background to help accurate positioning

Gutter
the white space between the left and right-hand pages of a "spread"

HPGL
Hewlett Packard Graphics language, the office standard

Hyphenation
means of breaking words over the end of justified text lines. A hyphenation dictionary carries a list of words that can usually be successfully hyphenated and where in the word the hyphen should appear

RIP
Raster image processor. The device in typesetting equipment which interprets the digital page description

Run around
Text which follows closely the outline of an illustration – sign of sophisticated DTP software

Running head
line of text which appears at the top of every page

Scaling
changing the size of a picture, expressed as a percentage of height and/or width

Scanner
device which converts artwork or photographs into digital form

Style sheet
a set of type style and page design rules which can be automatically applied to a layout

Tag
a style specification connected with a particular block of text or paragraph

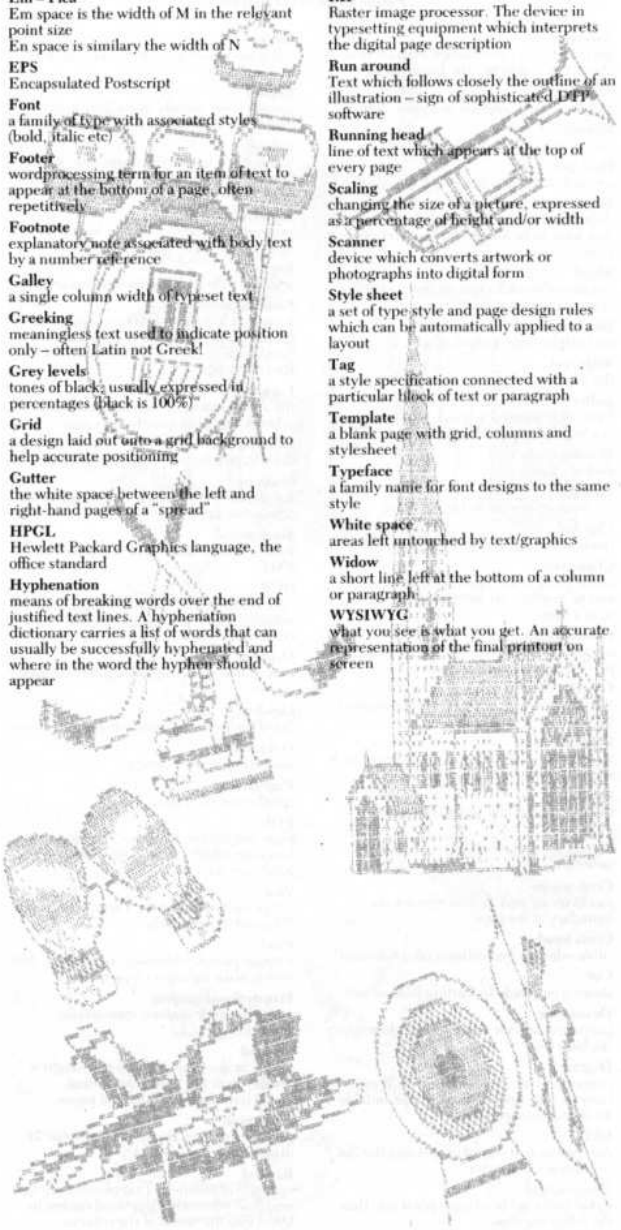
Template
a blank page with grid, columns and stylesheet

Typeface
a family name for font designs to the same style

White space
areas left untouched by text/graphics

Widow
a short line left at the bottom of a column or paragraph

WYSIWYG
what you see is what you get. An accurate representation of the final printout on screen



Clipart from Xtra Xtra

Paul Fellows

Paul Fellows has a few random thoughts

BASIC provides a very effective random number generator in its RND function. But what can random numbers be used for?

Most of us will have used them for plotting shapes of random size at random positions on the screen, either to create patterns or landscapes. Another common use is to vary the order in which a series of questions are presented so that quiz type programs don't become too repetitive. However, there are many other, more sophisticated, applications for random numbers. This article looks at a couple of these in action.

Pi in the sky?

When algebra fails to reduce a mathematical problem to a simple formula, the computer can step in and provide a brute-force numerical solution. However, mathematicians often come up with problems which, even with today's very powerful computers, can take excessively long using these methods. It is at this stage that the most unlikely approach of using random numbers can prove effective. Methods based upon random numbers are known as *Monte Carlo simulations* after the famous gambling centre.

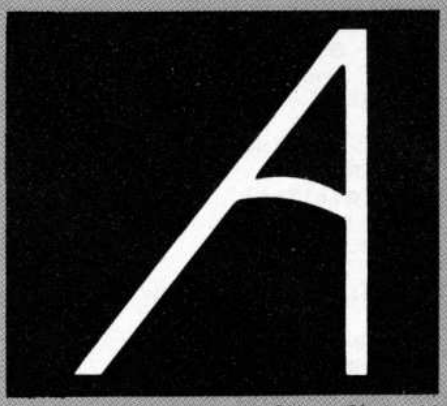
The simplest example of a Monte Carlo method is based on the hit-or-miss principle and allows us to calculate the area enclosed by a curve. Points are chosen at random and, if they lie within the curve, then a "hit" is registered, if it is outside then the point is counted as a "miss". If enough points are chosen then the number of "hits" and "misses" will reflect the relative areas of the "inside" and the "outside" regions.

The program given in **listing 1** uses this technique to get an approximate value for the area of a circle. Using this we can get an estimate of the mathmatical constant PI.

The program draws a square with a circle inscribed within it. The radius of the circle is 256 and so the area is **PI*256*256.** The sides of the square are twice the length of the radius and so the area of the square is **256*2 * 256*2 = 4*256*256**. Therefore, the ratio of the areas of the square to that of the circle is 4 to PI.

This fact is used to calculate the value of PI. The program picks random points inside the square and the calculates the distance from the centre of the circle. If this distance is greater then the radius the point lies outside the circle and otherwise it lies inside. The variables inside%, outside% and total% are updated accordingly and a point is plotted, yellow for outside and red for inside.

As more and more points are chosen the ratio of the number of hits inside the circle to the total number approaches the ratio of the areas of the circle and the square. Thus, after



enough random tries, inside%/total% should be equal to PI/4. The program prints out the value of 4 times this ratio after 10, 100, 1000, 10000 and 100000 points. The value should get more and more accurate, closer and closer to PI.

As given, the program uses integer arithmetic for speed but this limits the accuracy which can be obtained. In fact, the value obtained is too low, typically about 3.13. If line 60 is changed to

60 outer% = 256.5*256.5

then the value of PI is approached from the other direction and will therefore be slightly too high. The true value of PI lies between these two limits.

We could, of course, dispense with the random numbers and just scan each point once. The program could easily be changed to use a pair of FOR..NEXT loops to do this. So what is the advantage of using the random scattering technique? To answer this we have to look at the accuracy which can be obtained.

If we want to get a more precise answer we have to locate the border between the inside and outside regions more closely. To do this, we must use a much finer mesh than is provided by integer arithmetic and increase the number of sampling points which are looked at. The program can easily be changed to use floating point arithmetic for X and Y. This allows the program to seek out the border between "inside" and "outside" to a high degree of accuracy and so a very good value of PI can be obtained.

We can now see why the scanning of all the points is impractical. Using the full accuracy of the floating point we would have to scan astronomical numbers of points to get an answer. The random scattering technique can get an approximate answer with only a fraction of the number of calculations.

The rough and the smooth

The second program shows the use of random numbers to achieve realistic shading of a curved surface using a limited range of colours. The technique used is known as "dithering".

Two spheres are drawn. For each one, the light intensity of every point is calculated as a floating point number in the range 1 to 15.99.

For the first sphere, the integer value of the light intensity is used as the colour to plot the point in. For example, points of intensity 5.25 and 5.75 are plotted in colour 5. This results in bands of grey of different intensities being created which does not look very realistic.

To see how this can be improved, consider a single band, for example the one whose points have intensities between 6 (brighter, closer to the centre) and 5 (darker, further from the centre). These are displayed entirely in colour 5. What we really want is for the band to gradually have more colour 4 mixed in with it as the points intensities approach the lower limit.

The second sphere achieves this by comparing a random number between 0 and 1 with the fractional part of the intensity. If the random number is greater, then 1 is subtracted from the colour number. This means that a point with intensity 5.75 has a 75% chance of being plotted in colour 5 and a 25%

PROGRAMMING THE ARM

chance of being plotted in colour 4 whereas a point with intensity 5.25 has a 25% chance of being plotted in colour 5 and a 75% chance of being plotted in colour 4.

This effectively blurs the edges of the bands together. The roughness introduced by the random numbers smooths out the banding and gives the image a pleasing textured appearance.

```
LISTING 1

   10REM > PI
   20MODE 1
   30OFF
   40ORIGIN 1000,712
   50lim%=1
   60outer%=256*256
   70
   90WHILE lim%<1000000000
  100GCOL 7
  110inside%=0
  120outside%=0
  130total%=0
  140
  150lim%=lim%*10
  160

170RECTANGLE-256,-256,512,512
  180
  190CIRCLE 0,0,256
  200
  210REPEAT
  220
  230X%=RND(513)-257
  240Y%=RND(513)-257
  250
  260IF ((X%*X%)+(Y%*Y%))<outer% THEN
  270  GCOL 1
  280  inside%+=1
  290ELSE
  300  GCOL 2
  310  outside%+=1
  320ENDIF
  330total%+=1
  340
  350POINT X%,Y%
  360
  370pi by 4=inside%/total%
  380
  390UNTIL total%=lim%
  400PRINT lim%"
pi=";pi_by_4*4
  410
  420ENDWHILE
  430
  440END
```

```
LISTING 2

   10REM > Shade
   20REPEAT
   30MODE 12
   40FORI%=0TO15
   50  COLOUR
I%,I%<<4,I%<<4,I%<<4
   60NEXT
   70radius%=RND(256)
   80R2%=radius%*radius%
   90
  100ORIGIN960,512
  110PROCsimple_sphere
  120
  130ORIGIN320,512
  140PROCsmooth_sphere
  150UNTIL FALSE
  160
  170END
  180
  190DEFPROCsimple_sphere
  200FORI%=0 TO radius% STEP2
  210 FORJ%=0 TO
SQR(R2%-I%*I%)STEP4
  220
C=15*SQR(1-(I%*I%+J%*J%)/R2%)
+ 0.99
  230  C% = INT(C)
  240  GCOL C%
  250  POINT I%, J%
  260  POINT I%,-J%
  270  POINT-I%, J%
  280  POINT-I%,-J%
  290 NEXT
  300NEXT
  310ENDPROC
  320
  330DEFPROCsmooth_sphere
  340FORI%=0 TO radius% STEP2
  350 FORJ%=0 TO
SQR(R2%-I%*I%)STEP4
  360
C=15*SQR(1-(I%*I%+J%*J%)/R2%)
+ 0.99
  370  C%=INT(C)
  380  K=C-C%
  390  IF (RND(100)-1) > 100*K
THEN C%-=1
  400  GCOL C%
  410  POINT I%, J%
  420  POINT I%,-J%
  430  POINT-I%, J%
  440  POINT-I%,-J%
  450 NEXT
  460NEXT
  470ENDPROC
```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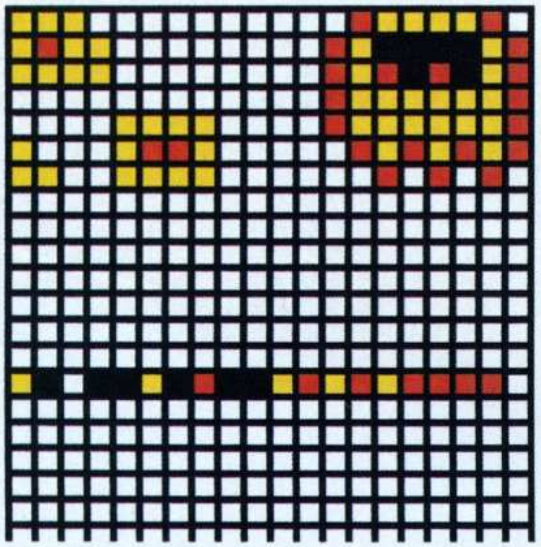

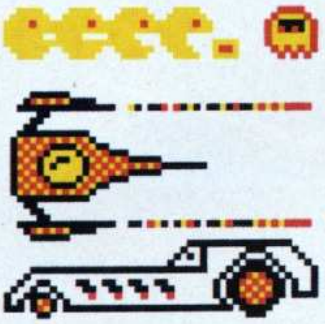

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GAMMA PLOT

Presentation graphics come to the fore with this new package from Minerva — to all intents a stunner

Gamma Plot is Minerva's new graphs and charts package for the Archimedes. Although totally rewritten as native Arc software, it is conceptually very similar to their System Gamma for the BBC micro which I reviewed in the May 1988 issue of A&B Computing. In place of the BBC ROM is a relocatable module with the user interface again written in BASIC – although not documented for the customers to use in their own programs. Gamma Plot has the same basic ingredients as System Gamma, in terms of data entry by custom editor or import from spreadsheet, a macro facility for programming the loading, display and customisation of graph displays and the saving of graph screens for enhancement by a separate 'Customise' program. However, Minerva have both learned from some mistakes in the design of System Gamma and made good use of the additional capabilities of the Archimedes. In particular, the Customise program is so sophisticated that it can be used as an effective art package in its own right. The documentation supplied is generally good, providing both tutorial introduction to the many facets of this package as well as a useful reference guide.

Data entry

One irritating feature of System Gamma that has been retained is that the data set for each graph must be loaded and saved as separate files, although multiple graphs can be overlaid on the same screen and saved together for customising. Manual entry of data, chosen by <Escape> from the main menu is an attractively designed, multi-coloured screen that

actually draws you a miniature version of the selected graph type in the top left hand corner of the window while you are typing the data in. The mouse can be used to select data cells for editing and for choosing various options on the top right of the screen. These include five types of graph: *scatter, line, histogram, pie chart* and *3D histogram*, options for best fit line, percentages, scaling and labelling with a choice of three fonts for the text displayed.

Since graphical data is frequently computed from other raw data formats, it will often be more convenient to import the data from adjacent columns in a spreadsheet and a very good facility has been provided for this. First of all, you may import data from an ASCII file which could be created by spooling from a spreadsheet or from text files created in other ways. To use this facility your file must be saved in a specified form with column entries separated by tabs and rows by carriage returns. Much more convenient for most users, however, will be the spreadsheet import facility reached by pressing **U** for utilities at the loading screen. In addition to Minerva's own Archimedes spreadsheet, *Sigma Sheet*, data can be imported from files created by the BBC *Gamma Plot, Intersheet, Viewsheet* and *CSV spreadsheets*. This facility requires no messing about with spooling sections of spreadsheets and is simplicity itself to use. All you do is give the name of your standard spreadsheet file and the cell references for the columns you wish to copy, and leave the work to the program.

Finally, you may wish to import data from a data base directly, rather than via a spreadsheet. Minerva have provided a powerful and sophisticated interface to their *Delta Base* and *System Delta Plus* files (BBC and Archimedes versions). This allows importing of text labels and numerical data from database files with options for frequency counts, averaging and other arithmetical operations. Exchanges of data are, of course, also allowed between DeltaBase and Sigma Sheet and the three programs work well together as a semi-integrated package, although each is also useable on a stand-alone basis.

Data display and the macro facility

When creating graph displays you will normally be working from the main Gamma Plot program selected by G from the main menu. Apart from *Escape* for manual data entry this program provides a number of other menu options. The current graph can be displayed or all graphs in memory displayed on top of one another. As in the BBC System Gamma, individually displayed graphs can be "windowed", ie resized and moved around the screen, so that different graphs can be displayed side by side when overlaid. Alternatively, one may wish to overlay a set of line graphs in the same position and on the same axes, though you will probably need to set the X and Y ranges manually to the same values to avoid rescaling problems between graphs. As with System Gamma, there is no apparent way for using different symbols to plot the points on each graph for easy distinction – the conventional practice on scientific graphs and an irritating omission.

When displayed, a graph or group of graphs can be dumped direct to printer or else saved as as screen for enhancement by the Customise program (discussed below). The printers supported are Integrex and Epson JX for colour dumps and Epson MX and FX compatibles for ordinary black and white dot matrix dumps. These routines must be quite sophisticated as Gamma Plot uses a 256 colour mode as standard (though with a 16 colour mode as an optional choice). The screen dump shown was created from a multi-coloured display and dumped to my Epson FX80 compatible Juki 5510 dot matrix printer. I was also shown some impressive colour printed dumps on a recent visit to Minerva's offices.

Also selectable from the main menu is a Macro facility, similar to that used in System Gamma. This enables users to write simple, high level programs to manipulate their graph data. Minerva have improved the Archimedes version by allowing print out of programs, key press dumping and saving of the screens drawn by the macros and the use of extended graphics commands corresponding to some of those in BASIC 5. In fact, the macro commands are a mixture of special commands for loading graph files, setting scales etc and BASIC commands for drawing graphics and printing text. The demo macro supplied is listed here as an example. It produces the screen used to illustrate the Epson screen dump. The macro concept is very similar to the programming language provided in Wordwise Plus, in that it enables users to program all the main functions of the system that can otherwise be executed by a sequence of manual operations in standard operation. A very powerful and useful facility.

The Customise program

Apart from the enhanced screen displays and excellent data importing facilities, Gamma Plot thus far looks not very different from the BBC version and slightly disappointing in that it lacks imagination in improving some of the defects. This comment most emphatically does not apply to the Customise program, however, which is a quite stunning art program in its own right. I have not seen Artisan, so I cannot make a direct comparison. However, it does contain two important features which I know to be lacking in Clare's program – the use of a 256 colour mode for painting (optionally 16) and the use of resizable text fonts. Whilst making very effective use of the mouse, the program also demonstrates that all that glitters is not WIMP. In this case, avoiding the use of the OS–Wimp routines which would have complicated the program and considerably slowed it down, may have been a positive advantage.

Incidentally, Minerva were at pains to point out to me that Gamma Plot is not being marketed as an art package as such and the Customise program should not strictly be assessed on these grounds. They are, apparently, developing a professional art package for the Archimedes that will leave it in the shade. However, it still looks like an excellent painting program to me, and the programmers clearly exceeded their original specification by quite some margin!

Customise can be chained from the main Gamma Plot menu, automatically loading the last screen saved, or loaded direct by pressing C at the start-up screen in which case you start with a blank screen. The program has a series of menus which overlay the drawing as a thin strip along the bottom of the screen and which can be toggled on and off with the menu button of the mouse. If starting fresh the screen is set to Mode 15 (256 colour mode with 80 character resolution) but may be reset to Mode 12 (16 colour mode with the same resolution). If loaded from Gamma Plot, the mode is determined by the screen to be customised. In the standard 256 mode, the colour can be chosen, with the mouse, from a full grid display of the 256 colours available when the colour menu is chosen. Because of the difficulty of discriminating all of these by eye, the colour can also be 'picked up' from an existing screen area by clicking the mouse pointer on any area of the painted screen. In the 16 colour mode, a standard set of colours including a number of grey shades is provided and unfortunately not redefinable. This mode is, however, useful for drawing diagrams etc intended for black and white printer dumping as opposed to painting full coloured art pictures. Note that I am discussing the program here as an art package rather than a mere 'customise' facility, because that is what it feels like and has been mostly used for in my household!

The drawing options provided are as follows: freehand painting with the mouse with redefinable size of brush and optional spray can facility; 'rubber banded' drawing of filled or unfilled shapes including straight lines, rectangles, circles, arcs and ellipses. The 'block' menu allows you to define a rectangular area of the screen which may then be moved, copied or saved as a disc file (creating a sprite of that screen section). The rectangle may also be drawn as a box of various types including shadow, rounded, double, sunken etc. The text facility allows text to be drawn in any of three fonts or a user defined one (loaded from disc and created by a font designer such as that on the Welcome disc) and with several independent X and Y scalings available. Text can also be drawn with surrounding boxes of the types referred to above. There is also a Zoom facility that provides an excellent pixel editor.

You may appreciate my difficulty in not considering this as a full blown art package in its own right. As a basic painting package, it has much to commend it and I have few complaints. The major one is that the shape of the mouse pointer is rarely redefined to show its function and in particular does not

indicate the size and shape of the current brush. Whilst conveying many advantages, the use of 256 colour modes is also problematic in so far as each screen occupies a massive 160K of disc space. No facility is provided for compacting the screen saves or for drawing in a 16 colour mode with redefinable palette for greater economy. These niggles aside, however, it must be said that if your wish is to produce standard screen size paintings in a full 256 colour mode, this program will provide all the essential tools you require. Needless to say, it is rather more than adequate for customising graphs and charts!

Conclusions

Taken as a whole Gamma Plot is a remarkably complex and powerful software package, which at a mere £69.95 must be the outstanding value for money buy in the Archimedes software market. Consider, in summary, all that you get for the money: a graphs and charts package that will satisfy most people's needs and incorporating its own programming language in the macro facility; excellent facilities for importing data from a variety of spreadsheets and any Delta Base type file; dumps for the 256 as well as 16 colour mode to both colour printers and standard Epson compatible dot matrix printers, and a quite excellent, 256 colour mode, mouse based art package. Frankly, I think they are a little crazy to sell all this at such a price, but Archimedes owners will be equally potty not to rush out and buy it!

● Addendum: Sigma Sheet and System Delta Plus

I have mentioned above that it would be advantageous to use Gamma Plot in conjunction with Minerva's data base and spreadsheet programs and I was also sent System Delta Plus and Sigma Sheet by the company. Apart from the programming facility of Delta Plus.

These programs have received reviews from other A&B writers already, so I will just offer some brief personal assessments. System Delta Plus is an excellent example of the OS–Wimp system being used to provide a most attractive and friendly interface. In particular, the ability to open windows on to several data bases simultaneously and to perform multi-tasking is quite excellent. The desk top environment provided within the program is also superior to that provided in by Acorn, though of course that is not saying much. As one who had set up several databases using the BBC System Delta (on ADFS discs which I read with my five and a quarter inch drive on the Archimedes), I particularly appreciated the fact that the system can read standard BBC Delta format files whilst providing the much superior user interface and the ability to convert to Archimedes format files with extended facilities, eg the use of multiple key fields for fast search.

Sigma Sheet is probably the weakest of the three, though by no means a poor program. As a basic no nonsense spreadsheet it provides considerable computing power allowing very large sheets to be created with extremely fast calculation and a number of useful mathematical functions. The decision to avoid WIMP here has provided a distinct advantage in terms of speed, although the non-WIMP use of windows in the user interface is clumsy and the poorest aspect of the package. The non-movable menu windows pile up in the centre of the screen, obscuring your view of the sheet you wish to manipulate. Exiting from a menu, for example chosen by accident, also wipes all windows off the screen requiring you to wend your way back to where you were. For some extraordinary reason the author has also not permitted you to select cells with the mouse, requiring instead that you trudge your way there with a series of cursor key presses. On the other hand, it must be said that Sigma Sheet is extremely friendly in its printing options, in that it can automatically select condensed mode to print an over width sheet, and split a really large sheet into sections printed in sequence.

Given the power and intercommunication of the three programs, they provide generally excellent facilities for both business and scientific uses at what are really remarkably low prices – certainly when compared with the rival IBM software you might buy to run under that oh so slow emulator. If only Minerva would rewrite the clumsy interface on Sigma Sheet, I could recommend the entire package without any hesitation at all. Even as it is, you could hardly buy better.

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Archimedes

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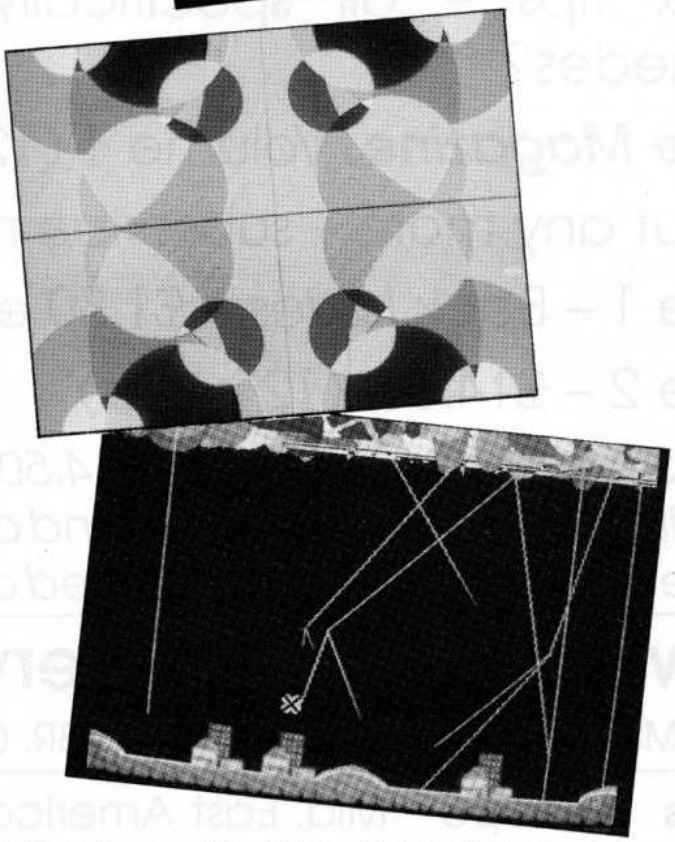

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Jonathan Evans

Logo on the Archimedes – pushing back the barriers in the classroom

Regular readers of the magazine will have seen several articles which I have written in the past year or so about the BBC version of *Logotron LOGO*. Whilst generally impressed with the language and its potential for list processing applications, I did, however, find that the memory limitations of the BBC prevented one from writing serious applications as opposed to demos and tutorial programs.

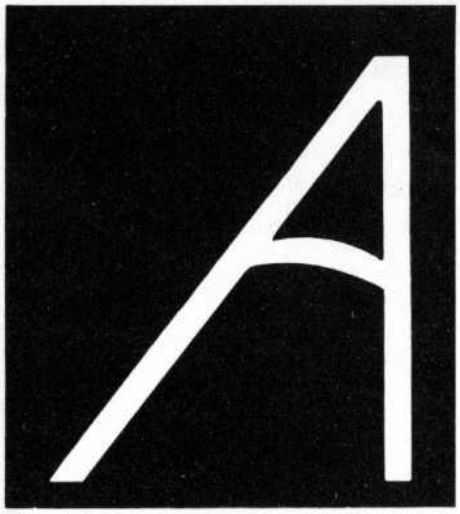
With the arrival of Logotron's LOGO for the Archimedes, however, that has all changed. The language has been rewritten and considerably extended for the Arc and provided that you have at least a megabyte of memory, serious applications, including small scale artificial intelligence programs, are now feasible.

Archimedes LOGO comes with two manuals which are both excellent in their own way but leave some serious gaps in the documentation taken as a whole. The tutorial guide starts with turtle graphics and extends to simple list processing examples (the listed small tutorial programs are also included on the disc). This is aimed at the complete beginner to programming and in places the style suggests that children are the main target audience. The alphabetic reference manual details all the commands of the new logo which include most of those which were in the extensions libraries of the BBC version and a number of new ones besides (see Table 1). There are, however, two major gaps in the documentation.

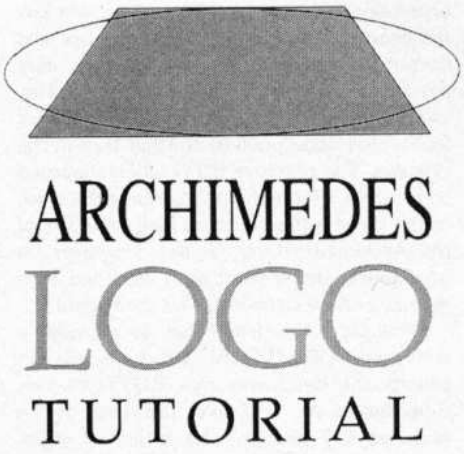
First of all, there are no instructions for setting up discs to run the language other than a dire copyright warning about copying the program. Secondly, the elementary nature of the tutorial manual means that many of the facilities and commands of this very powerful LOGO implementation are not touched upon. Hence, it is only possible to discover the full features of the language by reading through the alphabetical reference guide and piecing it together from the individual command descriptions – an exacting and time consuming process.

Setting up

The LOGO disc is protected, but the company will send you a backup on registration of ownership. However, the disc contains several directories with tutorial and demo programs as well as a some extensions files which you may wish to have available on your working program disc. I found that these could be copied using *COPY on to the disc which you can substitute after booting up from the supplied disc. There is, however, a further problem if you want to take advantage of the built in start-up facility. Buried in



the alphabetic manual, I eventually discovered the information that Arc LOGO looks for a file called STARTUP when booted and loads it automatically. It also looks for a procedure called STARTUP when loading any file and runs it if found. The combination of the two means that if you can have a program autorun on boot-up. The one which I wrote for my own purposes is shown in Table 2a.



The object of this start-up program is to load the extensions to the language which Logotron, for some reason or another, provide only on disc rather than as built in primitives. The INSTALLed extensions are automatically treated as primitives, but the the two files in the Logotools directory are simply LOADed as procedure libraries. In order that you can treat these as primitives also the command BURYALL is issued. Once buried, procedures are no longer saved with your workspace or entered into the editor by EDALL.

Finally, my procedure sets the editor space to a useful 64K as opposed to the miserly 8K or so (provided by default). This procedure will, however, only autoboot if you save it on to the supplied LOGO program disc. Writing to protected discs is risky, but since a backup was supplied, I risked a temporary release of the write-protect to save my STARTUP file. In the event this created no problems, but why Logotron expect their customers to work all this out with no setting up instructions, I really cannot imagine.

I had to make a further **SAVE** to the LOGO program disc when I later discovered an error in one of the procedure definitions in the ARRAYS library file. My version of PUTARRAY had a pair of brackets omitted from the second line of the definition and crashed with an error message when I tried to use it. The correct definition is shown on page 256 of the reference manual, so you can edit and resave the file if you have the same problem.

In case you think that loading all libraries and extending the space for the resident text editor will take away too much memory, I still have a workspace of around 350K left on my 310 machine after the autoboot. Although a version of the language can be used on the 305, owners of the small memory machine will need to upgrade to do serious programming in any language other than BASIC.

Extensions and compatibility

I suspect that many purchasers of Logotron's Archimedes LOGO will, like me, come to it from a knowledge of their BBC implementation. Ideally, one would expect a much more powerful version of the language which would be a superset of the BBC version and hence able to read and run any programs written with the simpler version. The power

Table 1

Primitives included in Logotron Archimedes Logo

```
ACN AND ASN ASCII ATN BK BF BG BL BACK BEEP BREAK BURIED? BURY BURYALL
BUTFIRST BUTLAST CI CO CS CT CAPS CATCH CHAR CLEAN CONTINUE COPYDEF
COS COUNT CURSOR DEFINE DEFINED? DIR DISTANCE DOT ED EDALL EDIT
ELIMINATE EMPTY? END EOF? EQUAL? ER ERALL ERASE ERFILE ERPLIST
ERPLISTS ERRMSG ERROR EXP FD FENCE FILL FIRST FOREVER FORWARD FPUT GO
GPROP HT HEADING HIDETURTLE HOME IF IFFALSE IFTRUE INSERT INSTALL INT
ITEM KEY? LN LT LAST LEFT LIST LIST? LOAD LOADPIC LOCAL LOOP LPUT MAKE
MEMBER MEMBER? MODE NAMES NOT NUMBER? OP OR OPNS OPPS OUTPUT PC PD PE
PI PO PR PRECISION PU PX PAUSE PEN PENDOWN PENUP PENUP? PLIST POALL
POS POTS PRINT PPALL PPROP PPS PRIMITIVES PRIMITIVE? PROCEDURES
PRODUCT QUOTIENT RC RG RL RP RT RW RANDOM READLIST READWORD RECYCLE
REDEFINE REDEF? RERANDOM REMAINDER REMPROP REPEAT REPLACE
RESETGRAPHICS RESETPEN RIGHT ROUND RUN SE SAVE SAVEPIC SCREEN? SCRUNCH
SETBG SETCURSOR SETDOT SENTENCE SETERR SETH SETHEADING SETMODE SETNIB
SETPAL SETPC SETPEN SETPENTYPE SETPOS SETPRECISION SETREAD SETSCRUNCH
SETSH SETWRITE SETX SETY SHAPE SHOW SHOWTURTLE SIN SOUND SQRT ST STAMP
STEP STOP SUM SWI TO TS TAN TEST TEXT THING THING? THROW TIME TITLE
TOWARDS TRACE TYPE UNBURY UNBURYALL UNREDEFINE UNSTEP UNTRACE UNWALK
UNWATCH VDU WAIT WALK WATCH WINDOW WORD WORD? WORDTOBYTE WORKSPACE
WRAP XCOR YCOR ZEROTIME .DEPOSIT .EXAMINE .NOEDITOR .SETEDITOR
.SHOWSTACK .QUIT WHO ALL TELL BUTTON MOUSE DEC RESERVE RESERVED CALL
```

Table 2

(a) Suggested startup file for Logo on Archimedes 310 or 400 series

```
TO STARTUP
INSTALL "$.EXTENSIONS.TOOLS
INSTALL "$.EXTENSIONS.TURTLES
LOAD "$.LOGOTOOLS.LOGOTOOLS
LOAD "$.LOGOTOOLS.ARRAYS
BURYALL
.SETEDITOR 64
END
```

(b) Patch for BUTTON command

```
TO OSMOUSE
MAKE "RESULT SWI "OS_Mouse [ ]
OP :RESULT
END

TO OSBUTTON
OP ITEM 3 OSMOUSE
END
```

and extensions are certainly there; the compatibility is high by not 100%. Since both versions of LOGO maintain program files as pure Ascii there is no problem with file compatibility provided you have a means for transferring your files on to the small disc format. As a test, I transferred one the lengthier BBC LOGO programs that I had written – the blocks world simulation published in the November 1987 issue of A&B.

When attempting to run this program under Archimedes LOGO, it initially crashed with some syntax errors. Two were easy to understand and correct, PROD has become PRODUCT and .SETNIB has lost its dot and become SETNIB. The other was more baffling. I had some Boolean procedures which returned values by OP TRUE and OP FALSE. In BBC LOGO these are primitive procedures returning the Boolean values, but the Arc version rejected them as unknown procedures. Sure enough, the reference manual had no entries for TRUE and FALSE either and with no index it took me a lot of time studying the demo listings and hunting through the manuals before I finally found the explanation right at the back of the reference manual headed SPECIAL WORDS.

Apparently the words TRUE and FALSE themselves represent the Boolean values in Archimedes LOGO, so the solution is to use OP "TRUE and so on. This is a good example of how the organisation of the manuals makes the discovery of the simplest details to be really hard work.

In addition to the greatly enhanced speed, memory and graphics capabilities – all due to the architecture of the Archimedes itself – Logotron LOGO is considerably extended, relative to the BBC versions, in terms of the primitives and library procedures provided and must be regarded as an exceptionally powerful implementation of this language in the context of personal computers. In addition to the extended procedures for handling lists and arrays – some of which are discussed below – I like the fact that good access to the Arc's operating system has been provided. This is achieved partially by a greater range and power of graphics commands, allowing for example the plotting style (EOR etc) to be set by a new command SETPENTYPE – a sad omission from the BBC version. I was surprised that SETPAL for logical colour changes was restricted to the old style VDU 19 equivalent of two numbers and not the four number form used by BASIC to set red, green and blue components of a colour. However, a general VDU command is provided.

Of great importance is the inclusion of the SWI command which works in a similar way to SYS in BASIC. This permits calling of Operating System routines (for window management etc) and the use of input and output parameters lists allows very easy passing and receipt of the machine register values. Unfortunately, my first use of this facility was occasioned by another fault in the language. The primitive BUTTON is supposed to return a 3 bit number describing the state of the three mouse buttons (see page 301 of the Archimedes User Guide). However, in my experiments it stubbornly returned zero no matter how vigorously I hit the rodent.

The patch listed in Table 2b provides a command OSBUTTON which works in exactly the same way that BUTTON was supposed to do. SWI takes the name of the required OS routine plus a list of input register values (in this case OS–Mouse and an empty list) and returns the output state of the registers as another list. Since R2 contains the button state on return from the routine this is extracted as the third item of the output list.

Lists and arrays

In my previous articles on LOGO, I have emphasised the importance of the list processing features of the language – a data structure entirely absent from BASIC, but a feature of artificial intelligence languages such as LISP, PROLOG and POP-11. A list is a set of data objects connected by pointers and may be of any length. A list structure, permitted in LOGO, allows members of a list themselves to be lists and so on. These structures are very flexible and powerful for representing almost any kind of knowledge which does not fall into simple categories such as arrays of numbers or strings. The list processing facilities in Archimedes LOGO are sufficiently powerful to permit serious programming, especially in view of the size and speed of the machine.

There is, however, a price to be paid for the flexibility of lists, particularly in speed of operation. For example, if you want to access the 100th item in a list, the language will have to search the pointers and links from the start. With an array, on the other hand, the address of each indexed item is stored when the array is created so that the items may be found directly and much more quickly. As an example, try creating a list of 100 or so items in LOGO and using the primitive SORT to order them. You will find this to work very slowly, indicating the huge amount of computation required to rearrange such a complex data structure. A conventional sorting algorithm applied to an array would work in a fraction of the time.

Clearly, the ideal is to have both lists and arrays available in the same language. Happily, this is now available in Archimedes LOGO provided that procedure library ARRAYS in LOGOTOOLS is loaded – as in my STARTUP file (Table 1). To illustrate the power of having both structures available, I have written a short demonstration program (Listing 1) which reads words from a text file and counts their frequency. This is a simple example of text processing which is one of the tasks that a list processing language on a large memory computer is ideally suited for. You can, for example, represent at text as a list of words, or as a list structure with embedded sub-lists for each sentence. Sophisticated programs could then search for categories of word usage or match syntactic patterns against the sentences and so on.

Returning to the more modest word count program in Listing 1, the start procedure is COUNTFILE. One of the first things it does is to call MAKEFILELIST to read the file from disc and construct the entire text as a single list of words in memory. In order to strip punctuation and convert to upper case, the file has to be read character by character which takes a while on files of any significant size. The word count itself, however, is very fast as it uses a technique called hashing.

One approach to the problem word count problem would be to construct a list containing a single entry for each unique word found in the filelist being searched together with the number of entries. The problem would be speed of execution, since an increasingly long list would have to be searched repeatedly, from start to finish, for matches. Using an array with slots for each word would also be slow as the words would be unsorted and also require long serial searches. The traditional solution – hashing – means that the address in which the words are stored is computed from some characteristic of the words themselves. A typical example might involve setting up a hash table with 100 slots, and then computing the location of each word by adding up the Ascii codes of the individual letters and MODing by 100. The problem, however, is that you are bound to generate duplicates, ie different words with the same hash code, that somehow must be stored in the same slot.

The ideal data structure for a hash table is an array dimensioned to the size of the table, whose slot contents consists of lists of variable size to cope with duplicate entries. An array of lists is a structure available in Arc

LOGO and used by my program. The table actually consists of an array of 26 lists (created by MAKEABARRAY) and the hash code is based simply on the first letter of the word. Once the file has been read into memory as a list of words, the procedure WORDCOUNT is called. Note the syntax FOREACH (provided in the LOGOTOOLS library) which allows an operation to be specified for each member of a list regardless of its length, with ? representing each item in turn. The procedure applied to each item is UPDATEARRAY which inspects the slot in the hash table array allotted to the appropriate initial letter. If the word is not present it is added to the slot's list together with the frequency count 1. If it is present then the frequency count is incremented using the REPLACE command (another which would be slow if applied to a large list).

The contents of the hash table after counting the words in the "Blocks world" program contained a total of 1188 words, but after loading the words into memory, the actual word count was achieved in a mere 67.19 seconds. You could, if required, add a further procedure to extract the words and their frequencies from the hash table and sort into one alphabetical list. Although this would require sorting each sublist and joining them together, the execution speed would be many times faster than if you had collected the word count as one long list and then sorted that.

Conclusions

Logotron are to be congratulated on producing an excellent implementation of LOGO on the Archimedes which will permit a range of serious applications, including artificial intelligence work. It is interesting to compare it with the equally excellent BASIC 5 provided by Acorn with the machine. BASIC is a powerful and straightforward language for a range of orthodox programming procedures and has, of course, the advantage that programs can be ported to any standard machine.

On the other hand, Archimedes LOGO while retaining the traditional advantages of the friendly turtle graphics and learning environment for children, provides a truly powerful list processing language for applications – such as text processing or expert system development – which benefit greatly from this facility. I personally expect to use both languages but for rather different types of application. Unfortunately, the portability problem will be crucial in some cases. For example, it would be much easier to write an adventure game in LOGO but much more lucrative to write it in BASIC and make it available to the whole Archimedes market.

Whilst an excellent first edition of the language, Logotron Archimedes Logo is not perfect, as I have indicated. There are one or two errors in the language itself and the documentation needs urgently to be supplemented by setting-up instructions. It is also unfortunate that there is no tutorial manual aimed at the more advanced types of application that this language will certainly permit. Time and editor permitting, I may be able to remedy this latter fault to an extent in some future articles.

Listing 1

```
TO COUNTFILE :FILE
(LOCAL "LIST "SIZE "T)
MAKEABARRAY
MAKE "LIST MAKEFILELIST :FILE
MAKE "SIZE COUNT :LIST
ZEROTIME
WORDCOUNT :LIST
MAKE "T TIME / 100
PR (SE :SIZE [words found and counted in] :T [seconds])
SHOWARRAY :AB
END

TO INRANGE? :A :L :U
IF AND (:A ) (:L - 1)) (:A ( (:U + 1)) [OP "TRUE] [OP "FALSE]
END

TO DISPLAYFILE :FILE
; Read file from disc and print to screen
SETREAD :FILE
UNTIL [EOF?] [PR READLIST]
SETREAD []
END

TO EXPANDWD :WD :C
; Add character to word if alphabetic and
; convert to upper case if necessary
LOCAL "A
MAKE "A ASCII :C
IF NOT (OR INRANGE? :A 65 90 INRANGE? :A 97 122) [IF EMPTY? :WD [OP
:WD] [OP LPUT "* :WD]]
IF :A ) 90 [MAKE "A :A - 32]
OP LPUT CHAR :A :WD
END

TO BUILDWORDLIST
MAKE "WORD EXPANDWD :WORD :CH
IF EMPTY? :WORD [STOP]
IF EQUAL? LAST :WORD "* [MAKE "WORDLIST LPUT BL :WORD :WORDLIST PR BL
:WORD MAKE "WORD "]
END

TO MAKEFILELIST :FILE
; Read file and construct contents as one list of words
; removing punctuation and converting to upper case
PR [Reading words from file]
MAKE "WORDLIST []
MAKE "WORD "
SETREAD :FILE
UNTIL [EOF?] [MAKE "CH RC BUILDWORDLIST]
SETREAD []
OP :WORDLIST
END

TO SHOWWORDS :LIST
; Print list with one word on each line
FOREACH :LIST [SHOW ?]
END
TO WORDCOUNT :LIST
PR [Counting words in file list]
FOREACH :LIST [PR ? UPDATEARRAY ?]
END

TO MAKEABARRAY
MAKE "AB ARRAY 26
END

TO SHOWARRAY :ARY
(LOCAL "C "I)
MAKE "C (ARRAYCOUNT :ARY) - 1
FOR [I 0 :C] [SHOW (SE :I GETARRAY :ARY :I)]
END

TO UPDATEARRAY :WORD
(LOCAL "INDEX "ENTRY "WP "WC)
MAKE "INDEX (ASCII FIRST :WORD) - 65
MAKE "ENTRY GETARRAY :AB :INDEX
MAKE "WP MEMBER :WORD :ENTRY
IF EQUAL? :WP 0 [MAKE "ENTRY (SE :ENTRY :WORD 1)] [MAKE "WC ITEM :WP +
1 :ENTRY MAKE "ENTRY REPLACE :WP + 1 :ENTRY :WC + 1]
PUTARRAY :AB :INDEX :ENTRY
END
```

Gordon Taylor

Archimedes REPORT

Gordon Taylor takes a look at Image processing and analysis on the Archimedes

Introduction

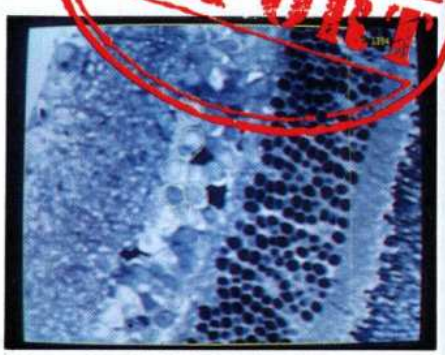
There are two key items of hardware required for scientific and technical image prcessing. The Watford Video Digitiser, which comes with some software, and the Summagraphics Bit Pad Two, while relevant applications include "DIGIT" from the Institute of Ophthalmology, and "AIM" which originated at the Delft University of Technology, and is almost free.

1. Archimedes running DIGIT, showing microscope with "camera lucida".

Watford Digitiser

The Watford Video Digitiser and its use for image manipulation was described in A&B October 1988, p 24. The hardware is a standard Archimedes "podule", the size of a single Euro-card, which plugs into the Backplane. The Digitiser hardware consists principally of a very high speed analogue to digital converter, together with 128K of RAM to store the image.

The BNC socket at the rear of the Digitiser may be connected directly to a suitable video camera (mono or colour). Most video recorders also have connections for "composite video" (or CVBS). This allows them to provide a source of images – both from tape, and direct off-air, from the in-built tuner. The connecting leads may be purchased ready-made, or made up easily from inexpensive components. When using a video recorder, it is best to grab images off running tape, since still-frame tends to jitter. When using a video tuner, to acquire off-air pictures, it is best to mistune slightly, to lose the patterning effects caused by the colour signal. To do this, it may be necessary to disable the automatic frequency control, eg by opening the tuner flap.



2. Screen shot of DIGIT, showing video image with cursor cross and X and Y co-ordinates.

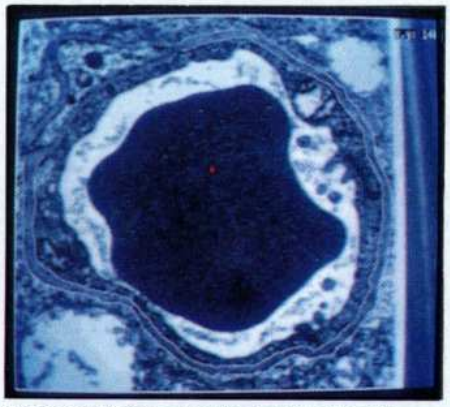
Broadcast television is an analogue system, but the digital equivalent of the colour is around 24 bits/pixel (giving a palette of 16 million). This is approximately equivalent to 8 bits/pixel of monochrome brightness (ie 256 grey levels). The Watford Video Digitiser has been designed to produce monochrome images, which enables it to be simpler and less expensive. (It can produce full colour images, by grabbing Red, Green, and Blue images in sequence, eg by using coloured filters). Monochrome images are in any case adequate for many image processing and analysis applications. The brightness resolution of the Watford Digitiser is 6 bits/pixel (ie 64 grey levels), which is the maximum that the Arc can display. (As a comparison, the Atari ST can only display 16 grey levels and eg the SAM video digitiser matches this, with a brightness resolution of only 4 bits/pixel).

Each "frame" of European television is broadcast as two interlaced "fields", each equivalent to about 768 x 288 pixels. The Digitiser normally produces images of 512 x 256 from a single field. It can grab and display (in a 16-colour/grey level mode) full-screen images at 12.5 fields/s, and quarter-screen images at 25 fields/s. (This latter is half the rate at which fields are transmitted in European television). If required, the Digitiser can grab both the odd and even fields in close succession (from a suitably stable source), and display them in Mode 20 as 640 x 512 x 16 grey levels (on a multi-frequency monitor).

The resident software consists of a relocatable module of some 28K, which is held in a ROM on the Digitiser, and usually copied into main memory at switch-on. (This may however be disabled by *UNPLUG DIGITISER). On-line help is provided for the syntax of all the star commands (but not the SWIs). Commands are included for: grabbing an image (into the digitiser memory), saving it to file, and loading from file into digitiser memory, or onto the screen.

Image Display

On a colour monitor (which is virtually standard on the Arc), Digitiser images are displayed at either 320 x 256 x 16 grey levels in Mode 9, or at 640 x 256 x 16 in Mode 12. (The 256-colour modes provide only 4 bits for each of the 3 primary colours, and hence only 16 grey levels on a colour monitor). The full 64 grey levels can only be displayed by using a 256-colour mode, and a monochrome monitor, or a colour monitor which has a composite video input (such as the Philips CM 8533). Image processing can benefit from the use of Mode 20, with 512 scan-lines,



3. Stresscraft setup, showing Archimedes and Polariscope.

which requires a multi-frequency monitor. This mode is optional with the Digitiser and the DIGIT software, but essential with the AIM package (see below).

Image Processing

Effective image processing requires that the digitised images contain enough information, and that several can be held on screen and in memory. In practice, this means from about 256 x 256 x 8 bits/pixel (= 64K) to about 512 x 512 x 8 bits/pixel (= 256K). The Watford Digitiser can acquire such images (at 6 bits/pixel), and

even the Arc 310 can hold one or more on screen and in memory at once. Many image processing operations involve comparing every pixel with its neighbour – and often several – and are often iterated many times. Hence image processing needs a powerful processor – which is why the Arc is so much more suitable than a Model B or Master or an original IBM-PC, which have perhaps one twentieth as much power, or even an Atari ST.

The resident software of the Watford Digitiser includes routines for image manipulation – SWI Vdig-Scale for scaling up or down of any rectangular part of a digitised image, with options of horizontal and vertical flipping, with output to the whole screen, or to any rectangular window, and SWI Vdig-Rotate for rotating an image about any centre, with options of scaling up or down, and plotting at the graphics cursor position. Other routines are provided for image processing: *SMOOTH averages each pixel with the nearest neighbours to remove noise at the expense of detail, with the option of repeating the process several times. *ZIT removes unwanted spots (usually due to noise).

SWI Vdig-Tables allows the reading and writing of a lookup table, through which pixels may be passed – eg to match the current palette. With suitable contents, the table may be used for contrast enhancement and for thresholding. Hence these routines would allow you to write your own image processing programs. However, there are at least two packages already available commercially – DIGIT and AIM – and others are in prospect – Stresscraft and TCL-Image. (see below).

Documentation

The manual is very neat, with some 78 A5 pages and a lay-flat binding, and the contents are well organized in 21 sections, plus index. It documents the hardware, the resident software, and the utility and example programs very clearly. It must be particularly helpful to third-parties who wish to access the Digitiser from their software.

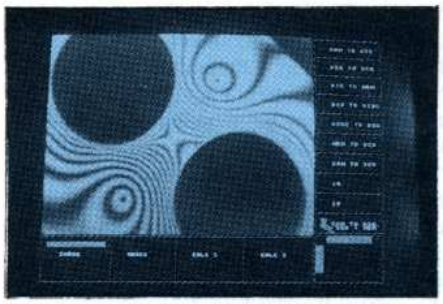
Availability

The Watford Video Digitiser for the Archimedes is priced at £249 plus VAT.

DIGIT

DIGIT is an image analysis package, originating from the Institute of Ophthalmology, in London. It assists the user in counting points or objects, measuring distances between points or objects, and digitising the shapes of objects by hand. From the resulting "shape" files, the perimeter, area, equivalent radius, volume, Feret (ie calliper) diameters, centre of mass, and several "shape factors", may be calculated.

DIGIT was developed originally on the Model B/Master, where the image was from direct viewing via a light microscope or a photograph (eg from an electron microscope), and data was entered via a tablet, so that the computer had only to



4. Screen shot of Stresscraft software, showing video image of fringe pattern.

store and manipulate co-ordinates. The Arc version will run in a 305, and requires only a standard monitor. In addition, it supports the input of images via the Watford Digitiser – from a camera, a TV tuner, or a video recorder. DIGIT can also work with images that have been digitised, and saved to disc.

With the DIGIT package, data is entered by hand using a tablet or a mouse. This is very useful for objects, photographs or video images with low contrast, and uneven density across them. These characteristics are often present in microscope images, and makes them difficult to analyse automatically.

The tablet supported by Digit is the Summagraphics Bit Pad Two, Model 1103. The required configuration may be downloaded at the start of the session, or – especially if it is to be used with only one application – may be set via three DIP switches (as detailed in the DIGIT manual). Although the back of the tablet must be removed for access, I found them easy to set, and it then worked perfectly. The power lead is connected to a separate power supply, and the data lead to the serial port. (The data lead is included with the DIGIT package). When running under the Arthur 1.2 operating system, a later version of the module "RS423" must be loaded, to ensure correct operation of the serial port.

When viewing objects directly via a microscope, the measuring point may be superimposed by mounting a small LED to the cursor "puck" of the tablet, and viewing it via a "camera lucida" attachment. This is well-suited to accurate measurement of a few features per image, since the position of the "puck" is measured with a resolution of 2700 in 11 inches (ie 245 per inch) in X and Y.

The same resolution applies when positioning the cross-hairs of the "puck" over a photograph placed on the tablet. When viewing objects directly via a microscope, the "camera lucida" may instead be used to superimpose the view of a special, cross-shaped pointer on the screen. (see Fig. 1). Its position can then be measured only to the nearest pixel, with a resolution of 512 x 256 with a standard monitor, or 512 x 512 when using Mode 20 with a multi-frequency monitor. However, this is well-suited to counting and measuring a large number of objects per image. When viewing video images, the measuring point again consists of a special, cross-shaped pointer on the screen. (see Fig. 2). This may be moved with either the "puck" of the tablet, or the standard Arc mouse, but the measurement accuracy is again limited to the resolution of the screen.

The DIGIT menu map is shown in Table 1. When counting points (or objects)

Table 1 DIGIT MENU MAP

1. Point Count	Output Filename ? Mark with Class Numbers ? Print Counts ? Count from Video Image ? Screen/Image/Grab
2. Distance between Points	Output Filename ? x1/Enlargement/Reduction Magnification/Reduction ? Measure a Video Image ? Screen/Image/Grab
3. Digitise a Shape	Change Sensitivity ? Output Filename ? Trace a Video Image ? Screen/Image/Grab
4. Display/Print Shape File	Shape Filename ? Magnification/Select/Print
5. Correct a Shape File	Input Filename ? Output Filename ? Comb Value ? Delete Point/Other
6. Measure a Shape File	Input Filename ? x1/Enlargement/Reduction Magnification/Reduction ? Save to Disc ?
7. Measure Width	Input Filename ? x1/Enlargement/Reduction Magnification/Reduction ?
8. Plot Histogram	Data Filename ? Bin Width ? Frequency/Percent Frequency
9. Edit etc Datafiles	Write Datafile Read Datafile Correct Datafile Combine Datafile Make ASCII File Manipulate Datafile
10. Use Watford Digitiser	View Video Image Save Video Screen to Disc Save Video Image to Disc Load Video Screen from Disc Load Video Image from Disc Convert Video Image to Screen Print Video Screen from Disc
11. Enter * Commands	
12. Exit from DIGIT	

via option 1, you can print the counts as well as saving them to disc, for each class in turn. When measuring distances between points or objects via option 2, you are prompted regarding the scale and units, as well as the values saved to disc. When digitising a shape via option 3, you are prompted for any change in sensitivity (or tracing interval). You can then trace continuously around the shape while the cursor key is pressed, and save the values to disc by pressing the key in the right-hand margin of the screen. Shape files may then be viewed or printed via option 4, and corrected via option 5. When using video images, points are marked with a dot, and you have the option of labelling them with class numbers, the lines between points are marked, and shapes are outlined on screen.

Data from single shapes may be processed via option 6, to obtain the measurements detailed above, and that for pairs of shapes (open or closed) via option 7, to give the mean width, number of measurements, and the standard deviation. Data files of points counted by classes, distances between points (lengths), widths or measurements of shapes may be displayed and printed as a histogram via option 8, which also calculates the mean and standard deviation. Option 9 allows you to examine and correct the above data

files, and enter data directly for display as a histogram. Data files can also be converted to ASCII format, for export to word processors, databases, and spreadsheets etc. Several functions of the Watford Digitiser may be accessed from within DIGIT via option 10.

Auxiliary programs are available for further processing of the data obtained with DIGIT. DISMAP takes such data and produces contour maps. DISTIT takes the outlines of objects traced with DIGIT, and uses nearest neighbour analysis to show whether they are regularly or randomly distributed. 3DIGIT takes multiple sections traced with DIGIT, and allows them to be aligned, shown in 3-D with zoom and rotation about all three axes, and enhanced and animated. The surface area, volume and volume density may then be measured.

One of the merits of DIGIT is that it is written entirely in BBC BASIC. Moreover an excellent ARM BASIC editor is supplied with the Arc, and full documentation to the language and the editor is included in the User Guide. Hence it would be possible for users to modify the program to suit their particular needs.

Documentation

The A4 manual has just 20 pages and a lay-flat binding. However, it documents setting up of the Bit Pad Two tablet, followed by about a page on each menu option, and ending with appendices on the measurement conventions used.

Availability

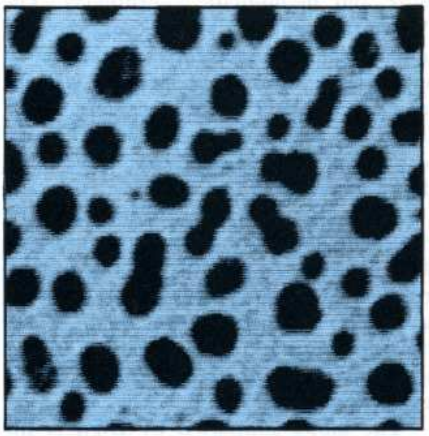
Digit is available from the Institute of Ophthalmology, and is priced at £150 (no VAT). The auxiliary programs DISMAP. DISTIT, and 3DIGIT are each priced at £50 (no VAT), and the LED is priced at £40 (no VAT).

The Summagraphics Bit Pad Two tablet, Model 1103, with a power supply and a 4-button cursor puck, is available from Reflex Ltd, and is normally priced at £541.60 plus VAT. (A lower price applies to purchasers of DIGIT).

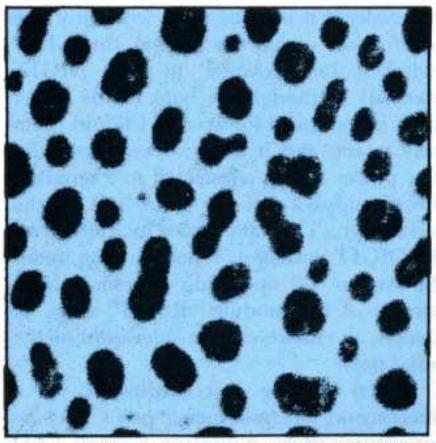
Stresscraft

An image processing and analysis package is being developed on the Arc by Stresscraft Ltd., for use in photo-elastic stress analysis. In this technique, physical models are built of the structure, using special transparent plastic. These are loaded at elevated temperature, and then cooled so that the resultant strains are "frozen" in place. The 3-D models are then cut into 2-D slices for analysis. This is done by illuminating them with polarised light, and viewing the resultant "fringe patterns" via a polarising filter (or analyser). Hitherto, this has been done largely by highly skilled operators, using direct viewing, and manual adjustment and logging.

The availability of low-price video cameras, video digitisers, and computers such as the Arc bring the prospect of computer-aided photo-elastic stress analysis, even with semi-skilled operators. Stresscraft are using a Panasonic 1550 (low light) video camera, the Watford Digitizer, an Arc 440, and an NEC MultiSync monitor. (see Figs. 3 and 4). The software is under development, and is intended to aid the analysis of both the "isochromatic" fringes, which give the magnitude of the principal stresses, and the "isoclinic" fringes, which give their directions, and hence enable a full-field analysis. Although it may be a year before the system is complete, I mention it as an example of what the Arc can do, and because photo-elastic techniques are a valuable complement to Finite Element Methods.



5. "cermet" image before processing, printed with Epson FX-80.



7. "cermet" image before processing, printed with Epson GQ-3500.

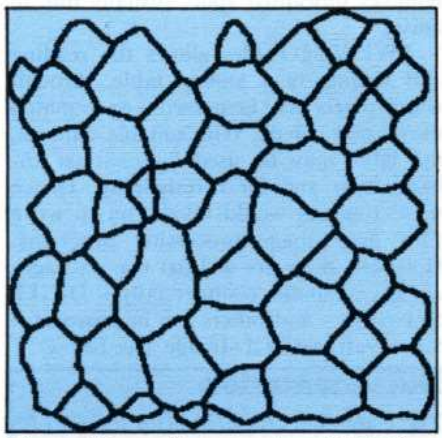
AIM

The Archimedes Image Manager (AIM) is an image processing and analysis package developed at the Delft University of Technology, in the Netherlands. The program was first implemented on an Atari ST but – being written in C – was then ported to a Sun workstation, and later to the Arc. It was intended primarily for use in teaching courses, but thanks to the higher resolution display and the higher processing speed, the Arc version is also capable of useful work. It requires at least a 310 and a multi-frequency monitor.

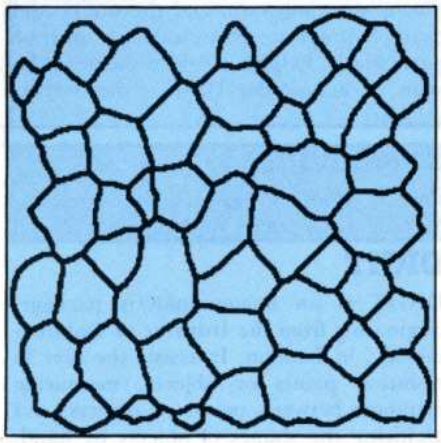
The spatial resolution of the image is determined by the number of pixels in the X and Y directions. AIM stores images as 256 x 256 x 8 bits/pixel (ie 256 grey levels). When the images are "grabbed" with the Watford Digitiser, only 6 bits/pixel are supplied. By using a multi-frequency monitor, these are displayed in Mode 20 in windows of 256 x 256 x 4 bits/pixel – using a "sigma-delta" technique to represent the original 256 grey levels as closely as possible. Although Mode 20 can only display 16 grey levels, AIM can perform operations using each of the 8 separate bit-planes.

Grey-scale image processing tasks that may be carried out with AIM include : – making the image less sharp (smoothing) – representing the slope strength (gradient) – extracting detail (detail) – enhancing detail (crispening) – extracting edges or high-contrast areas (edge) – finding local extrema (min, max).

Bit-plane image analysis tasks that may be carried out include : – identifying objects by specific characteristics. – labelling objects in certain size classes. – measuring the number, length, perimeter, and area of objects.



6. "cermet" image after processing, printed with Epson FX-80.

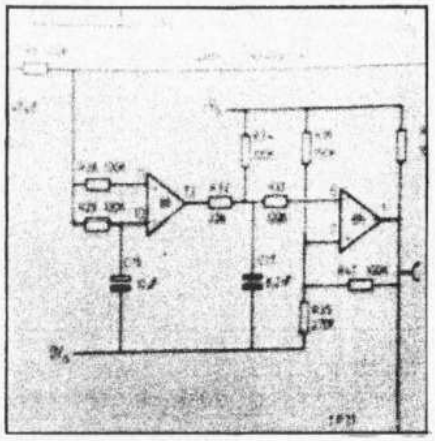


8. "cermet" image after processing, printed with Epson GQ-3500.

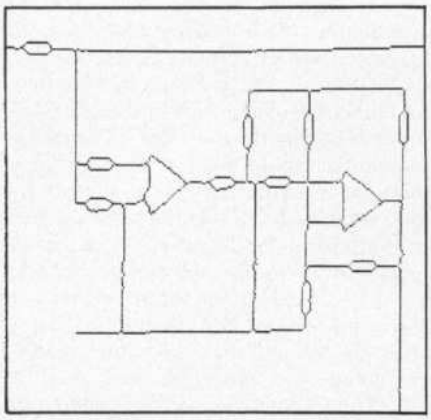
Such image processing and analysis may be for eg – medical diagnostic or quality control inspection purposes, among many others.

The best way of seeing what is possible with the AIM package is to run the

demos, which are in the form of "macros" (sequences of commands), which operate on the several example images supplied. A simple demo is "democer", which starts with an image of particles in a matrix, finds the regions surrounding each particle, and labels them (with colour on screen).



9. "scheme" image before processing, printed with Epson GQ-3500.



10. "scheme" image after processing, printed with Epson GQ-3500.

(Figs 5 and 7 represent "before" and 6 and 8 represent "after"). The most outstanding demo is "demosch", which starts with an image of a dirty and faded drawing, identifies components of various shapes and sizes, and labels them (with colours on screen). Even so, it takes only about 90 s. (Figs 9 and 10 represent "before" and "after").

In Use

AIM is implemented on the Arc using multiple windows – three or four for images, and one for commands – with two interfaces. The mouse and pointer may be used with multiple menus organized as a tree-structure, to enter commands which are echoed in a command window, or the keyboard may be used to enter them directly. They must be in lower case, but the minimum number of letters that are unambiguous may be used. (This is very convenient in use, and is safeguarded by the response "Ambiguous command"). Most of the commands have several "arguments" or parameters, which typically identify the input and output images, and such things as the source bitplane or number of iterations. All the arguments have defaults, but specific values can also be entered. The command line affords access to all 110 commands, but the menu system affords access to some 69 commands. The upper levels of the AIM menu map are shown in Table 2. Alongside some of the options are the number of options in a sub-menu. Only some of the commands are discussed below, but they should serve to indicate the scope of the AIM package.

Table 2

File	GreyOps	CelOps	BinOps	Utilities	Help
readf	clear	erosion	bcopy	hist	
writf	copy	propag	and	display > 5	
grab	arith > 11	skelet	or	timer	
load setup	thresh	-skelet	exor	dump	
save setup	unif	contour	invert	shad	
macro	lmax	majority	set	mcopy	
logging	lmin	remove	reset		
exit	median	spec pix > 4	label		
	laplace		distance		
	nlaplace		measure		
	gradx				
	grady				
	specials > 8				

File operations

Selecting eg "readf", "writf", or "macro" brings up a file selector box, showing the pathname and the names of the files of the appropriate type. This also has "buttons" for MOUNT and DRIVE (to allow the disc or drive to be changed). If you want to save a binary image (ie a single bit-plane), it is best to copy it to all eight bit-planes first, with "mcopy". Otherwise, on loading such a file, it may appear to be garbage (at least until you select the correct bit-plane). "grab" acquires a series of video images via the Watford Digitiser (if fitted). Pressing any key stops it and retains the current image.

The full power of AIM lies in using sequences of operations. Given the large number of commands, and that many of them can take multiple arguments, the scope for experimentation is enormous. However, once a useful sequence has been found, selecting the "logging" option opens a file, to record a sequence of commands as a macro, and selecting it again closes the file. Moreover, such files may be combined by calling them from other command files – to a nesting depth of 16.

Grey-Scale Operations

As well as the straightforward "copy" of grey-scale images, sample copy operations are available via the command line. "scopy" takes arguments which control manipulations, such as reflect horizontally, and rotate. "arith" leads to a sub-menu of arithmetic grey-scale operations, such as "cadd", which adds a constant to an image, "ginv" which subtracts the image from 255, and "mul" which multiplies two images together. "thresh" (ie thresholding) transforms a grey-scale image into a binary (black/white) image.

The remainder of the options in this menu are grey-scale filters. There are several linear filters, with fixed shape and size (3 x 3) eg: "gauss" for smoothing, "gradx" for representing the gradient in X, "laplace" for enhancing detail, and "nlaplace" (negative laplace) for extracting detail. "unif" is a linear filter of variable size, also for smoothing, and there are many others – for smoothing, representing gradients, and extracting detail.

Non-linear filters are also available in AIM. These can perform image operations that are impossible with linear filters – eg suppressing noise without degrading the edges. Some are of fixed shape and size (3 x 3) eg: "median" averages over the neighbourhood, and removes noise. (The effectiveness of this is shown in "demo5"). Some of the filters are of variable shape and size eg: "lmin" (ie local minimum), which extends the dark parts in an image (also known as "grey-scale erosion"). There are also a couple of adaptive filter commands.

Cellular Operations

These operate on bit-planes, and on white objects. Hence if objects are black, you should use "inv" first. Several of them iterate automatically, and stop when no pixels change, but you can also specify a number to stop sooner. They include: "erosion", which peels off layers of white pixels, and "dilation", which adds layers of white pixels. Given that a skeleton is a line one pixel wide in the middle of white objects, "skelet" produces the skeleton, with end pixels or edge-crossing lines, and "-skelet" produces the skeleton, without end pixels. Special pixel operations are used on line figures (ie drawings), and include : "endpix", which marks the end points of lines, and "vertices", which finds the corners of drawn objects. (These are used notably in "demosch", which extracts objects of several different classes from a dirty and faded drawing).

Binary Operations

These too operate on bit-planes, and include : "bcopy", which copies one bit-plane to another, and "and", "or", and

"exor", which combine two bit-planes in various ways. "label" labels the connected components within a binary image. There can be up to 255 labels, and a colour display can be used to show up to 16. "meas" counts white objects which are more than 12 pixels in size, and measures the length, perimeter, area, and several shape parameters of each. If however you require a printout, or there are more than the 28 objects that will fit in the command window, then two further arguments may be included. The first is a "flag", which should be set to 1, and the second is a filename to receive the data. This file may then be printed, or read into another program for performing further calculations.

Utility Operations

"hist" produces a histogram of the brightness levels in a grey-scale image, and overlays it on the image. In addition, the threshold, minimum, maximum, mean and variance are returned in the command window. "display" leads to a submenu, which includes : "gdisp" to display (or refresh) a grey-scale image (eg – to remove a histogram), and "bdisp" to display one bit-plane of an image. "timer" toggles timing on (and off), so that the time taken for each operation is returned in the command window, and "dump" takes two co-ordinates and the image as arguments, and returns the grey-scale values of a block of 8 x 8 pixels, starting with the co-ordinates at the top-left.

Printing

AIM has no direct support for printing images (eg via *HARDCOPY). However, users with a Watford Digitiser can use the utility program AIMtoDIG to load their AIM image files into the Digitiser memory, from which it may be printed using *PicDump. This supports dot-matrix printers (both 9-pin and 24-pin). From my brief experiments, the best printer dumps were obtained with *PicDump followed by S (for ShowPic, to refresh the picture, and erase any commands), W8 (for a width of 8 inches, the maximum for the printer), D3 (for the maximum, quad, density), P6 (for the pattern recommended for use with quad-density). When printing AIM images, I also used H8, to achieve the same unit aspect ratio, rather than the 5:4 at which they are displayed on screen, by default. (see Figs 5 and 6).

Watford also offer (at extra cost) routines for dumping Digitiser images to page/laser printers – specifically the Hewlett-Packard LaserJet, the Epson GQ-3500, and PostScript printers (and their compatibles). These all offer at least 300 dots per inch, and hence much finer patterns for reproducing multiple grey levels. (see Figs 7 and 8).

Documentation

The documentation of this public-domain program consisted originally of a "MANUAL" file on the distribution disc. However, it has since been printed as an A5 booklet of some 37 pages (in English), by the Big Ben Club of the Netherlands. This documents almost all the commands, for reference purposes, but it includes no tutorial section. However, the disc includes a number of demonstration "macros", together with example images, which may be run (and printed out, since they include some comments). Also on-line help is available on the syntax of many of the commands.

Availability

AIM is available in the U.K. from Lindis International for just £9 plus VAT, which covers the cost of materials (disc and manual), and packing and postage.

Watford hope to arrange to include AIM with the Digitiser. This would make sense, since a video digitiser is needed to input images into AIM – and the Watford is the only one supported. Utilities for moving Digitiser images to and from AIM image files would be included. They allow all the Digitiser software routines – including manipulation, processing and printing – to be used on AIM images.

The routines for dumping Digitiser images to page/laser printers are available from Watford Electronics, at a price to be determined.

TCL-IMAGE

There is the prospect of a full professional image processing package on the Archimedes – developed at the Centre for Image Processing, Delft University of Technology. TCL-Image is already available on PC-DOS machines, the Mac II, and Sun workstations. Acorn are supporting the porting to the Arc 440, which offers this application the performance of the Sun workstation at around half the the price of an equivalent Mac II, along with freedom from the MS-DOS memory size limit of 640K.

TCL-Image also uses images with a resolution of 256 x 256 x 256 grey levels as standard, (and can read AIM images directly). However, it can also handle larger images – limited only by the need to hold between two and four copies, together with the program, in memory at once. Whereas AIM supported only integer arithmetic, TCL-Image can also carry out floating point calculations. This allows Fast Fourier transforms to be performed on the images – eg for enhancing them in the frequency domain. Such capabilities are very valuable when analysing medical images, and in the field of robot vision.

As well as offering many basic image processing operations, TCL-Image includes a full structured programming language (Technical Command Language), which allows the addition of new operations, and the building of custom systems. It goes beyond the AIM macros by having both branching and looping constructs. TCL-Image is expected to be available around the middle of 1989, with a price of about £1000.

Conclusions

The Arc is especially suitable for image processing. Whereas the IBM-PS/2 with VGA and the Apple Mac II are limited to displays of 640 x 480 as standard, the Arc is capable of up to 640 x 512. This allows it to display larger video images during automatic processing and analysis. The Arc also offers a powerful 32-bit processor, capable of 4 million instructions per second (MIPs) as standard, and up to 4 MB of RAM, all directly addressed, at highly competitive prices. Indeed, the originators of the AIM package put the performance of the Arc on a par with the Sun workstation, at about one tenth of the price.

The DIGIT and AIM packages use different approaches to image processing and analysis. In DIGIT, the image may be a direct view or a photograph, and the data entered via a tablet, using the computer only to store and manipulate the co-ordinates. This allows the user to recognize patterns when analysing the image. In the Arc version, images may also come from video, while still allowing interpretation by the user. DIGIT supports the Summagraphics Bit Pad Two digitising tablet for entering data from images by hand, while both DIGIT and AIM support the Watford Video Digitiser for the input of images from video cameras, tuners, and recorders. In AIM, the input comes only from video images, and the information is extracted by automatic routines. However, these are powerful, and can be applied interactively, or via predefined "macros", which allow sequences of operations to be repeated automatically. Both packages can output data as files on disc, for further processing or incorporation in other documents.

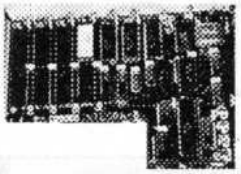
By putting AIM in the public domain, the Delft University of Technology has allowed many Arc users to explore image processing at low cost. This should reveal that many applications that hitherto required visual analysis and manual data entry can now be assisted or performed completely automatically. Moreover, even more powerful image processing packages for the Arc – both general and special purpose – are in prospect in the coming year.

Factfile

● The Institute of Ophthalmology is at : Judd Street, London, WC1H 9QS. ☎ 01-387-9621, Extn. 224. ● Lindis International is at : P.O. Box 10, Halesworth, Suffolk, IP19 0DX. ☎ 098685-476. ● Stresscraft Ltd are at : St Winefride's Chapel, Pick Street, Shepsted, Leicestershire, LE12 9BB. ☎ 0509-506019. ● Summagraphics tablets are available from : Reflex Ltd., Viewpoint, Gardener Road, Maidenhead, Berkshire, SL6 7RJ. ☎ 0628-771166. ● Watford Electronics are at : Jessa House, 250 Lower High Street, Watford, WD1 2AN. ☎ 0923-37774.

INTEGRA-β

The Expansion for the BBC Model B



The INTEGRA-β provides four operation modes - as standard Beeb or with shadow Ram and emulation of 'B+' and Master 128 features. Ideal for educational, commercial and data collection applications, as well as the private user.

An included battery-backup system, (which covers all fitted Ram), can save any data in Ram during a power-line disturbance or when the computer is switched off. Also, Rom images can be loaded from disc, stored and cleared at will, minimising the need for physical Rom changes. Compatible with DFS, ADFS and second processors conforming to ACORN® protocols.

Enjoy the facilities offered by the INTEGRA Operating System which allows you to run Model 'B+' versions of programmes with their added features also provides many of the features otherwise only available in the Master series. Control of sideways Ram even exceeds that available in the Master. Includes comprehensive machine configuration means, real-time clock with date, calendar and alarm features and commands for controlling the working environment. Will additionally allow use of the type 65C02 processor with it's enhanced instruction set.

Compatible with many applications, some of which are,
Inter-Word, Inter-Sheet, Inter-Base , Wordwise Plus from Computer Concepts. View-Sheet, View 3 from Acornsoft. AMX Super-Art, AMX Stop Press! from Advanced Memory Systems. The Publisher and Genie from Permanent Memory Systems. Music 5000 System and Ample from Hybrid Technology.

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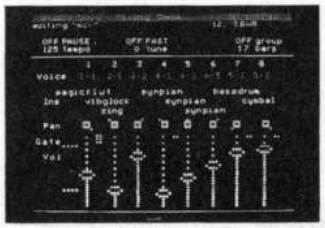

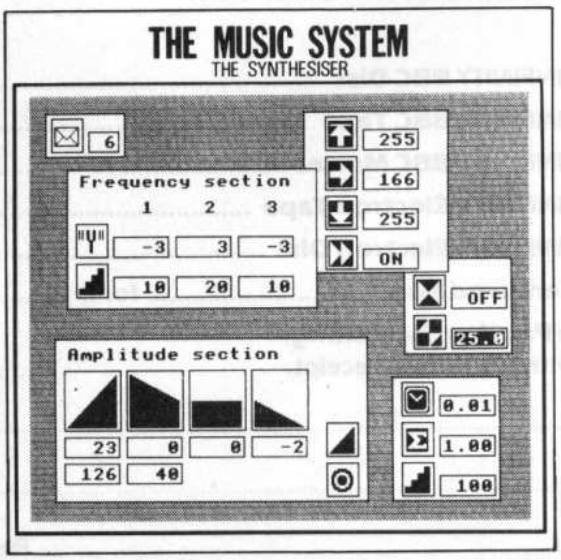

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A&B Computing was invited by Times Network Systems to look in on a school taking part in the biggest desk top publishing venture of the year: Newsday

It's the second week of the Olympics and the Ben Johnson drugs scandal is still simmering; Gorbachev is changing the history of the world out in Siberia; the space shuttle is about to launch; a family of four have perished in an A1 pile-up just a few hours before; the Swedish election results are "breaking". At Bretton Woods School, Peterborough the computer room has become the *newsroom* for the day.

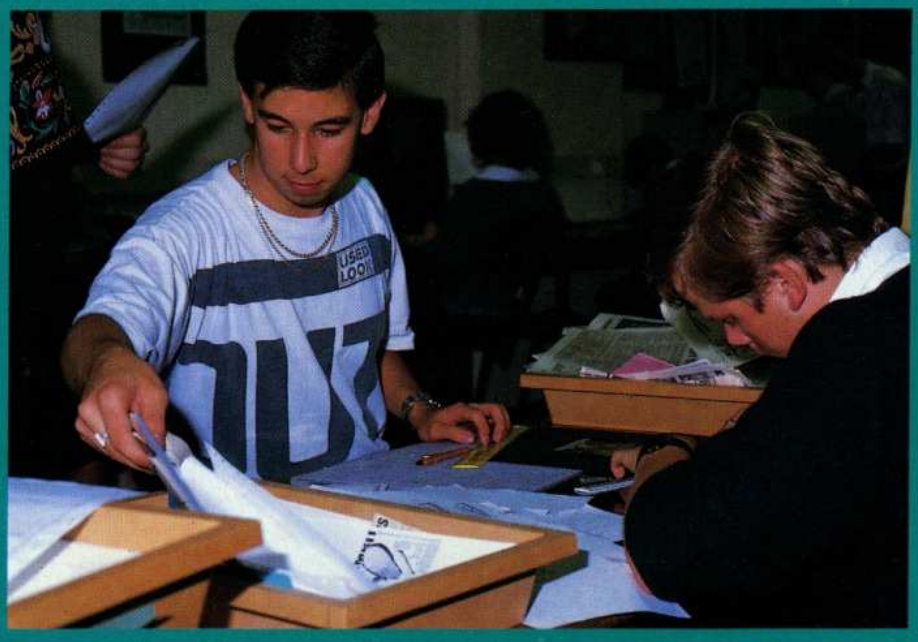
When we arrive mid-morning we are told that the work has been going on since 9am and will continue non-stop until after 4pm, winding down around 3pm. Enthusiastic students have obtained permission from their teachers to join the team at various stages throughout the day.

The Newsday entry requires a large team of researchers, writers, technicians and supervisors and the presence of four teachers is evidence of the school's commitment to the project. Other teachers are providing cover for those present.

There's support from the team leader at Middleton Primary School, a local school who completed their equivalent primary project earlier in the week. He arrives and is immediately employed in the typesetting department.

read history – Bretton Woods is also a centre for blind children.

The Olympic connection results in some interesting local stories including a canoeist and a weight lifter preparing for Barcelona, 1992! Before our very eyes a teacher taps into the Seoul computer via TTNS to print out the biographical details on an ex-pupil who is competing in the Tai Kwan Do. So now we know how Ron Pickering does it. The medal tables are available on Prestel should they wish to print them.



Reporters for the day

Some stories have been prepared in advance. "No newspaper is made in a day" says David Gray, head of information technology. For instance, there's the feature on Glen Hoddle. An ardent fan had a great time interviewing the star footballer by telephone after a training session in the south of France.

News stories connected with the school are featured: a short item on a 13 year old caught smoking; a fascinating interview with a teacher's son who, despite being partially sighted, is off to Cambridge University to

Other news comes in from foreign correspondents on TTNS and the modern language departments are employed translating selected passages. Students are encouraged to sift the available material to find an angle, to look for the real stories behind the news. Alot of background is required in order to handle some of the political and economic issues.

New technology is a feature of this year's paper and students have researched bar code readers at the local supermarket and the use of new technology around the school, including a satellite dish project.

Production

All around the room pupils are preparing work on BBC Micros. There's much good humour and a positive feeling about the work in progress. Each article is kept on its own disc while a large board on the wall keeps track of the stories in progress. Dictionaries and papers litter the tables. At appropriate moments during the day everyone present takes part in an editorial meeting to decide the continuing direction of the paper. Ideas

about bingo cards and cartoons are likely to be dropped for the hard news.

Bretton Woods have linked their publishing efforts with the world of professional newspaper publishing by forging contacts with the local evening paper the Evening Telegraph. The ET regularly carries a schools page and the Bretton Woods pupils have been to the offices to see the various stages of production.

Copy is typed into View on the BBC Micros, subedited and transferred to Folio for printing. A new typeface and layout have been chosen for this year's entry. It quickly becomes apparent that converting and printing out is going to cause a bottleneck in production but the team are confident they can sort it out.

The galleys are glued down in conventional fashion and the broadsheet artwork is going to be reproduced courtesy of a fast EMAP photocopier. A ballpark print run is agreed during a visit from Sheena Wallace, who handles the Evening Telegraph's links with local schools. The students decided not to spend money on a full-scale print run to add their paper to the ET. They maturely decided that the money could be put to better use.

Winners

Bretton Woods won the Newsday competition in its debut year, two years ago. Last year many of its star journalists were employed by the TTNS news service and the paper came second. Quite a pedigree. This year Tandon, the sponsors of the competition, are giving a first prize of a PC and laser printer. David Gray agrees they would go nicely in the computer room, next to the AIV Domesday system, and would make a big difference to their paper *next* year!

More on TTNS next month in our *Comms Special*
Photographs Andrew Brown

Quazar from Impact Software

ARC STARS

If you thought that the Arc was just good for professional applications such as CAD and DTP think again. It's also a mean little games machine as we find out

Setting Standards

Not surprisingly it was Superior Software who came up with the first games for the Arc. Both Zarch and Conqueror utilise 3D perspective landscapes that are as yet unsurpassed by any other machine.

For the few Arc owners out there who haven't seen either of these games here's a brief description of them both.

Zarch puts you in control of a small fighter that must skim the surface of your world looking for Alien Beasties that are planting nasty red viruses all over the place. Your job is simply to stop the spread by blasting away all enemy ships in the area.

Conqueror is programmed in a similar fashion although the gameplay is far more strategy based. Here you must deploy your tank divisions across the war zone blasting the opposing tanks away. The various tanks in the game have different strengths and weaknesses and handle the various terrains within the game with accuracy.

Blast Away

No computer worth its salt is without a handful of shoot 'em ups. The Arc is no exception. Some excellent games in this catagory have emerged most notably Alerion from DABS Press.

Alerion is a vertically scrolling, blast everything in sight type game which bears an uncanny resemblance to the 1984 Atari Coin-Op hit Xevious. The object is simple: you must travel up the screen shooting targets both in the air and on the ground. For this you have Air to Air and Air to Ground missiles which can be fired independantly of each other. Liberal usage of both is required if you are to succeed in your mission.

Apparently you have been less than an exemplary pilot in the past, so as reward your superiors (no pun intended) have sent you on a mission that they have every confidence you won't survive. However if you do, your past track record will be cleared and you will return a hero (hurrah!). So the moral of this story is clear – don't join the Arcturian Space Fleet 'cause they don't appear to have very good union agreements.

Anyway, you have all manner of nasties to destroy and you must constantly be aware of which targets are land or air based so you can select the right weapon for the job. This may seem obvious but believe me it can be confusing in the heat of battle. Your ship has four-directional movement although in practice I found that there's enough on your plate moving left and right and firing using two different keys to worry about going up and down as well although no doubt they'll be a

Star Trader from Gem Electronics

few of you out there who can (obviously my youth wasn't misspent enough). All gameplay keys can be defined to your specification which is handy for people with odd shaped paws.

The gameplay departs from Xevious slightly with the addition of the F bases which, when hit eight times, give you a few seconds invulnarability. You also have H bases which allow you to start from a new point if you first pass over it, thus removing the tedium of going back to square one every time you get gunned down.

As the rest of the crew in the office will testify this is quite an addictive game. The combination of good graphics and sampled sounds help of course but the actual gameplay itself is what really makes this game a winner. That and the Hi-score Table being saved to disc. My one complaint of the game is the control.

Why do people insist on using the keyboard for gameplay when there's a perfectly good mouse waiting to be used?

In a similar vein is Quazar although there is far less to this game than Alerion. Quazar is more akin to the Coin-Op Star Force. You must blast wave upon wave of alien starships above a 3D-ish landscape. On first appearance looks quite simple but is in fact quite tricky to master. Passwords are give for each level (even the first level for some strange reason) and of course backgrounds change accordingly as do the enemy flight patterns.

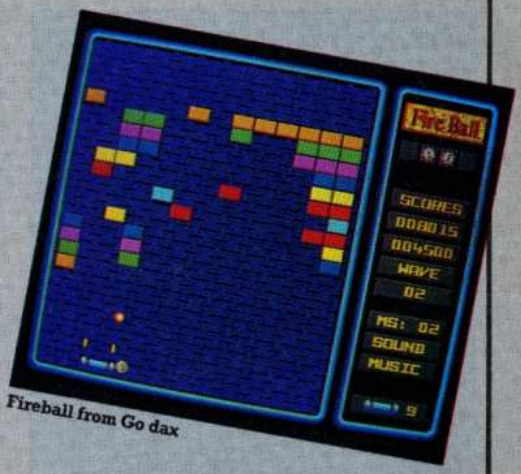
A nice blast 'em up but I strongly suggest you look at Alerion if this is the kind of game you're into.

Also in this catagory is Minervas Orion which is not unlike Planetoid/Defender along with Missile Control (a Missile Command clone) and our very own Blast! which is a super fast Galaforce-style space game.

There are some nice graphic adventure games emerging thanks to the likes of Minerva and Grandslam Entertainments.

Back in September Minerva gave us Hoverbod, a Jet Set Willy style game which involves guiding a little spherical chap round eight level of action before entering the Quest for Wings in which you must collect hundreds of feathers that are lying around in a rather large castle.

Once you've collected all the feathers you fly around the screen in glee and a sampled voice says "Try again". This is the reward you get for your efforts.



Fireball from Go dax

From Grandslam Entertainment comes Terramex which A&B reader Tom Allen passes judgement on...

To set the scene: An aged professor has predicted that a huge asteroid will strike earth in the near future. He had even worked out a way to stop it, but nobody believed him until the astrologists discovered that there was indeed an asteroid on collision course with our planet – but by this time the professor had died, and his plans were scattered all over the place. This is where you come in. In one of the four characters selected you must pick up all the parts of the equation before the earth is destroyed.

As I mentioned, you can choose from four characters at the start of the game (their nationalities are English, German, French and Chinese), and for each character there is a very slightly different way of solving the major puzzles. The game itself is excellent, and it is obvious from the very start that it was created by a very imaginative programmer (for instance, have you ever heard of a flying vacuum cleaner). There are some very comic moments when you make mistakes – like cannoning yourself into a cliff or being constricted by snakes. The theme tune is catchy – not irritating at all, and graphics are simply stunning. Control is via either mouse or keyboard, and there are two speed levels – I stayed on slow!

All in all, this is an extremely good piece of software that I would recommend to Arc owners as a valuable addition to their collection. Price £14.99.

Terramex from Grandslam Entertainments

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NEW>>>NEW>>>NEW>>>NEW Screenmaster

Video effects software

Professional video effects and advanced image processing. These machine code routines can be used to process any Mode 0, 1 or 4 graphics and are especially designed for use with digitised pictures.

The * commands are easily programmable for enhancing your own programs with "slides", "bangs", "fades" and many other screen effects. Screens can of course be recorded realtime onto video tape to create title pages, information screens and interesting links between footage. Pictures can also be prepared for desk top publishing packages.

Completing ScreenMaster are an image processing utility and a suite of programs which work directly with the Watford BBC video digitiser, offering user-friendly capture and animation of digitised images.

All in all, this is the most comprehensive suite of software for manipulating digitised images on the BBC Micro.

COMMUNICATE

David Janda

Telesoftware Dies

Commercial telesoftware within the UK is no more. Let me explain. Previously there were three types of telesoftware available on Prestel/Micronet and Compunet (a Commodore orientated system).

First there was, and still is telesoftware which can be downloaded free of charge (other than time charges plus call charge). Then there was, and to a small degree still is user software, which as the name implies is written by a user on the system and sold for a small cost.

Thirdly there was the real dream. Commercial telesoftware. Supplied by the professional software houses it was a quick way of getting hold of the latest titles, and, quite often at a reduced rate.

Both Micronet and Compunet have ceased supplying commercial telesoftware to their subscribers?

Both are not too keen to go into details, because they are slightly embarrased. However here are the reasons.

Most importantly is the reluctance of software houses to provide the on-line services with their titles. Even though Micronet and Compunet could offer a degree of protection for some types of software, the majority of packages had to be protection free.

The upshot of this is that any subscriber could download a title, and without too much difficulty, crack open the dismal protection and make copies left right and centre. The result is that not many software houses opted for telesoftware as a route for distributing their goods – a pity, but understandable.

The second reason is packaging. More and more titles are being sold today with fancy wrapping; maps, pictures, clue sheets a nice box, etc. You cannot download a box, and as a result many users felt they were being "done", even when the package was sold at a reduced rate as telesoftware.

A third reason is code size. Any savings in commercial telesoftware can easily be negated if the package takes a long time to download (because you're still clocking up units on the phone bill).

Now with micros such as the Amiga, ST, and PC the average length of a program tends to be significantly higher then that of an 8-bit machine. If you were asked 20 quid for a bit of telesoftware that would cost another few quid in telephone costs for the time it took to download then you would not be a happy person.

Now it could be argued that the ability to access the on-line system at higher baud rates, and a better form of file transfer (CET is duff) would be a way around the third problem. You would probably be right, but it wouldn't change anything at all.

So what's Micronet doing about supplying software? Well you can still purchase the latest commercial titles through Micronets Byte Mail (yet another Telemap venture), but they'll be delivered by *snail mail*.

As far as telesoftware is concerned Micronet should have their own gateway to their telesoftware computer (an Amiga!) in operation by the time you read this. All telesoftware will be free of charge which is both good and bad news. Good because subscribers will have access to dozens of freebies. Bad because the quality of programs will be lower as Telemap will not be able to pay authors as much as they did previously.

That's because Telemap could recoup some of the cost by charging for the program – which they cannot do now. Oh well, it's a sad situation.

My Choice

If you're a regular reader of this column, you might have the impression that I don't like Prestel/Micronet – and to a large degree you would be right.

However there *is* a lot of good stuff on the Net. Some of it's written by the small team in editorial, and a large amount is written by freelancers (like myself), or contributors who submit material on a volentary basis.

So if you're taking advantage of the A&B/Micronet offer in this issue and getting yourself a brand new modem and Micronet subscription for Xmas, you may be wondering what to look at first, why not take a peek at the areas I've listed below.

***NET NEWS#** Updated on a daily basis (except weekends), with at least two stories each day Micronets news service is the fastest micro related news in the UK.
News editor Ian Burley also happens to be a Beebon fan, and you can expect to see a healthy dose of Beeb related stories – some would say too many!

***M MOUSE#** Next stop is Micro Mouse, a daily(ish) comms column edited by Steve Gold. This is a "must" for any comms fan. Steve does not talk shop all the time, and quite often he will yap on about credit card scams, bank charges (and how to avoid them) and such like.

***WAVEGUIDE#** Anyone interested in media should take a daily look at Waveguide. It's a media magazine dealing with TV, radio and satellite. Edited by contributors John Cull and Ian Campbell it is the media magazine to which all others should be measured by.

An overstatement? No! Waveguide contains some of the best media writing you'll ever see either in print or in electronic form. The in-depth coverage contains reams of quality information relating to events in the TV and radio world. If ever there was a single reason to subscribe to the Net Waveguide is it.

***STARNET#** This is a strategy war game set in space. Played by anyone who cares to register at 30p per move (far too expensive) it's a lot of fun. Moves are made three times per week, and there's a dedicated chatline which Star Captains (sic) use to gloat over their latest victories.

***GALLERY#** If you want to edit your own mini-magazine then this is the area in which to do so. You can rent frames on a quartely basis for 99p per frame and bung up just about anything you like as long as it's not obscene. To edit a frame will cost 1p.

Reading through Gallery can be a laugh. There are a few devoted to Beeb users, but I won't bother listing them as they seem to change from one session to the next. A must for anyone flipping through the area is the Manchester Pub by Pub gallery which is edited by Mike Brierley.

As the name suggests it's a personal guide to the boozers in the lads home town. So what? Well the humour is second to none! Mike and his brother Dave (aka the City boiis!) used to edit larger galleries, but the dreaded time charges put rest to that – a real shame.

***XTRA#** This area is a right mixed bag and represents Telemaps first effort in branching out from non micro related material. The area is sub-divided into a number of columns including Slasher (gossip), Voltage (Hi-fi) and Taki-Talk (opinionated soap-box). You'll also find film and music reviews and in general Xtra is an area you'll either love or hate.

***CHATBOX#** Once upon a time Micronet used to feature a plethora of chatlines. A chatline being an area operated on a carousel basis with anything from 10 to 100 pages on it. Users can send messages to the chatbox which are read by anyone who is looking in. Despite what the suits at Telemap say the Prestel/Micronet tariff increase dealt chatline usage a mighty blow.

Now there is only one general chatline

that's used to the full and that is Chatbox. Part of the TMMC (The Midnight Micronetters Club) area, life is seen after midnight when the free window comes into effect. Don't just sit back and read, contribute a message or two – it's fun.

Well that's my personal look at the good stuff, now here are a few tips on what to avoide at all costs.

But wait! Why have I not mentioned the BBC MICROBASE. The weekly magazine devoted to Beeb users that's updated on a Monday. Well for the past few months Beeb coverage on the Net has been dismal. The area has been lacking an editor and as I write Telemap are looking for someone to fill the post. As it stands it's dismal, and the area should not have been negleted for so long given the fact that Beeb users on Micronet number in their thousands.

Come to think of it **Music City**; the computer music area (mainly Beeb) is pretty dismal with updates only happening now and then. And what about **Shift Break**, the independantly edited area for Beeb users that's been promised for months now. Where is it?

Come on Telemap, pull your collective fingers out!

The Dross

There are a number of areas on Prestel which are controlled by Telemap that should be avoided at all costs.

First there's an area called **20th Century Hamster**. Yes, it is a daft name. What's more it's a daft area. On open access to all Prestel subscribers is contains dozens of banal quizzes and games that just might tax the imagination of the average travel agents assistant.

But there's more! These games and prize draws cost. A typical setup is a quiz with about ten questions. You get charged around 15-20p per question and if you manage to complete the lot you're eligable to enter the prize draw. An easy way to waste a few quid – more if you get a few wrong answers and try again.

And what do you get for your efforts? One daft offering was a water pistol plus a tenner. Work it out for yourself, it doesn't take too many people to enter before Telemap are in profit!

Then there's **Hobbyspot**. A real anoraks dream this one. Within this lavitorial abiss is an area called **Earthlight**, the SF and fantasy area. Co-edited by train-spotter extrordinare, and Prestels resident village idiot Andy Cloke (aka 9e). It's a haven for the type of Gerry Anderson fans who's ideal pictorial delight consists of a latex covered Kate Kestral poster – avoid at all costs!

Oh, I must not forget **Sunday Splurt!** To be found on the TMMC area, it can best be described as a dismal attempt at parodying Sunday Sport. The big difference between the two is that the Sunday Sport is funny, the Splurt is not.

But above all the area to miss above all is the whole of Prestel/Micronet – between 8AM – 6PM anyway. That's because within this period time charges are in effect, and they are far too high.

The Underground

Finally I must mention the London Underground. No, not the railway system but a closed bulletin board.

Run by Brian Robinson and Ray O'Connell it costs ten quid for a one off lifetime subscription. For that you get access to a multi-user BB that features special interest groups (SIGs), multi-user chat, on-line games and much more.

The board is PC orientated, but there is a section for Beeb users which looks quite healthy. There's bags of downloads and bags of room for uploads as well.

The realy interesting aspect of the system is the software that's being used to run the system. Forget the technicalities, the upshot is that it's a doddle to use.

So, is it worth a tenner to subscribe for life? Speaking as a Beeb fan I'd say no, not at the moment. The sysops should get more downloads for the Beeb and Archie be they programs or information files. A deARC program for Beeb computers would also go down well as that would allow us Beeb users to look at text files that were compacted with IBM PC utilities.

Having moaned there *are* a lot of facilities, and subscribing to a BB such as this one is handy as a "base" especially if you happen to be living in London.

For more info make a data call to the London Underground now. It'll handle any speed you care to think of, and don't forget to tell them that A&B sent you. The numbers are: 01-863 0198 and 01-427 8856.

contex

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Using this simple data link, it is possible to solve all your BBC to Archimedes data transfer problems. The kit is supplied with a disk, and the necessary cable to connect the two computers. Using this package it is possible to transfer any data from the BBC to Archimedes at upto 19200 baud.
By far the easiest way to transfer data to your new computer.

Only £25

Archimedes 5¼"/3½" Disc drive Interface

With this interface it is possible to connect almost any 5¼"/3½" disc drive with its own power supply to the Archimedes. NO SOLDERING is involved. Supplied complete with necessary lead.

Only £19

Note: This is not simply a lead. Attempting to connect an external disc drive by direct connection may result in damage to your Micro.

New

By Popular demand we are now supplying refurbished and fully guaranteed BBC Micro Model B with Disc Filing System

(Please telephone for price & availability)

The 80186 Co-Processor

This package consists of the Master 512 board, Watford Co-Pro Adaptor, 1770 Disc Upgrade and Acorn ADFS. This is a complete package, with its own power supply, ready to interface with your BBC Micro. The Master 512 board using the 80186 16 bit Processor at 10MHz and running Digital Research DOS Plus, gives a high degree of IBM compatibility at an extremely reasonable price. Included in the 512k package is a mouse and the amazing Digital Research GEM suite of software; GEM Paint, GEM draw and GEM desktop giving a complete Mouse Icons environment (All other GEM packages will work on the 512k). Famous packages that will work with the 512k board include Wordstar, Dbase II, Lotus 123 and many others. The only requirement to upgrade any BBC Model B to this system is you must have twin 80 track disc drives.

New low price **£175**

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MASTER 128K Micro incl. Acorn's: View, Viewsheet, ADFS, BASIC Editor & TERMINAL plus £125 worth of FREE OFFER (see below) **£379**

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*Gemini's OFFICE MATE & OFFICE MASTER packages on Disc consisting of: Database, Spreadsheet, Beebplot graphics. Accounts packs: Cashbook, Final Accounts, Mailist, Easyledger, Invoice & Statements, Stock Control and **Watford's** 3½", double sided 1 Megabyte (unformated) single disc drive complete with cables, ready to connect to the micro – with every BBC Master purchased from us this month.*

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65C102 2nd PROCESSOR

This amazing package consists of the Acorn 65C102 'Turbo' Board, the Watford Co-Pro Adaptor and Acorn 1.2 DNFS ROM. The 'Turbo' board, running at 4MHz with 64k of additional RAM will increase the speed by between 50 and 200% depending on the application running, and allow a BASIC program of upto 44k in any screen mode. Simply by plugging in the Co-Pro and the DNFS ROM with its special Tube host code and you massively increase the power of any Model B. This is a complete package, with its own power supply, ready to interface with your BBC Micro.

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Continued

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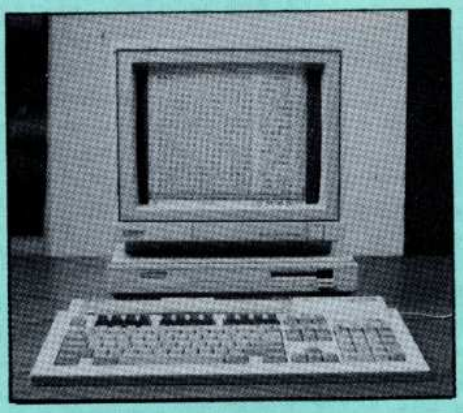

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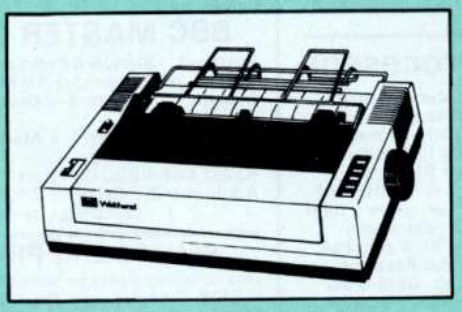

Panasonic KX-P1081

The Panasonic 1081 dot matrix printer handles text printing at speed, features business quality printout and links beautifully with graphics, CAD and DTP software.

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With every Z88 purchased from us this month, we are giving away absolutely FREE, a Z88 to BBC Interface Link, 4 rechargeable batteries and a compact Mains Battery Charger worth £38.

ACCESSORIES

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512K RAM Pack	£169
Z88 Spellmaster for Pipedream	£51
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Z88 XMAS PACKAGE OFFER

This special offer package consists of: A Z88 Micro, 128K Ram pack, Mains Adaptor, Carrying Case & a Set of Kodak batteries.

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CO-PRO Adaptor

With this Watford's Co-pro Adaptor unit, you can now attach any BBC Master coprocessors to your original BBC B.
Use the super fast Turbo Board with your BBC B, it is much faster than the 6502 2nd processor superseding it.
With the 512K addon your standard BBC machine achieves IBM PC compatibility at a realistic price running GEM, Lotus 123 and many other programs. Included with the 512k package is a high precision mouse and the Digital Research GEM suite of software; GEM Desktop, GEM Write GEM Paint. This requires both the 1770 DFS and the ADFS to be fitted to your computer.
To use other co-processors you require a BBC B with DNFS 1.20 or higher, or BBC B+ fitted with 1770 DFS 2.20 or greater. Co-processors work exactly like a second processor.
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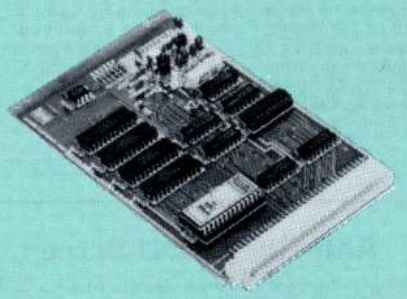

Watfords' Archimedes Video Digitiser is the most sophisticated digitiser ever designed for a micro. It provides a fast and flexible means of capturing images from a video camera or recorder for display and manipulation on the Archimedes range of Micros. Off-air television signals may also be digitised via a video recorder or TV tuner.

Once captured, Video images can be stretched, squahsed, rotated, stored on disk, printed, or used by applications software.

Applications include desktop publishing, graphics, animation, image analysis and recognition, medical imaging, automatic inspection and measurement, databases, interactive video, remote transmission of pictures via a modem, movement detection ... or anything else you can think of!

SPECIFICATION

SOFTWARE
All the driver software for the digitiser is contained in a ROM on the podule. Facilities provided include:

- Grabbing of images to the screen or dumping to memory.
- Continuous grabbing and display for previewing or camera alignment.
- 'Hot key' grabbing – pressing a (configurable) key combination grabs and displays an image on the screen while another program (e.g. paint software such as Artisan) is running.
- Scaling (zoom/shrink) any section of an image to any size in X and Y directions, with optional X/Y flip, window clip and logical (AND/OR/XOR) plotting.
- Rotation and scaling to any angle and size, rotating about any point, with optional window clip, and logical (AND/OR/XOR) plotting.
- Very versatile matrix printer screendump facility for Epson FX, LQ and EX compatible printers – pictures can be printed to ANY size (including multiple sheets) at any orientation, using any available printer density and one of six internal sets of dot patterns, or with user definable patterns (pattern editor supplied). The screen-dump can also be used for general purpose graphics screen printing.
- Pixel value lookup tables: pixel values can be passed through a user defined lookup table to allow contrast enhancement, thresholding pseudo-colouring etc.
- Smoothing and noise spot removal to enhance image quality.
- Creation of sprites from all or part of a digitised image.
- Saving and loading of digitised images in compressed format.
- Combination of pictures by adding, avaraging, subtracting, multiplication etc.
- Much faster versions of the Arthur *ScreenLoad and *ScreenSave commands.

Software facilities are accessed via operating system star (*) commands and SWI calls. High resolution screen modes using MultiSync type monitors are supported.

UTILITY DISK
A disk is included, containing sample pictures, examples and utility programs including the following:

- Colour image grabbing using colour filters with monochrome or colour cameras, including colour balance adjustment and scaling facilities.
- Pattern editor for 2 colour display modes and printer screendumps.
- 512 line interlaced display for non MultiSync monitors.
- Thresholding to create two colour images.
- Capture and replay of animated sequences.
- Several example programs illustrating the use of digitiser software.

RESOLUTION
Images are digitised to 512 (h) x 256 (v) pixels, and then scaled to fit the Archimedes' screen. It is possible to digitise to 512 x 512 pixels if the picture is stationary for about 0.1 second. 512 x 512 images can either be displayed on a MultiSync monitor, or on a normal monitor using interlacing.

Pictures are digitised to 64 levels of grey (6 bits). Note, however, that it is only possible to display all 64 levels on a monochrome monitor, or a colour monitor which has a composite (CVBS) input. For this reason, the Philips CM8533 monitor is recommended instead of the standard Archimedes monitor. It is also possible to connect both a colour and a monochrome monitor at the same time.

Any 2,16 or 256 colour graphics mode can be used to display digitised pictures. In two colour modes, grey levels are represented using dot patterns, which may be redefined if required (a pattern editor is supplied).

Cont.

SPEED
Video fields are captured in real time (1/50th sec.), and then transferred to Archimedes' memory or the screen. The grab/display rate is dependant on the screen mode and picture size, up to 25 fields per second for quarter screen images, or 12.5 per second for fullscreen (Mode 9).

HARDWARE
The digitiser is a single width podule, with a BNC socket on the rear panel for the video input, which may optionally be terminated via a link. There is 128K of on-board memory to store the digitised image, and a 32K ROM on the podule contains all the driver software.

Automatic video level control and black level clamping circuitry is used to ensure that the optimum contrast is obtained from a variety of video sources. A filter is included to avoid patterning effects when using colour sources.

Price £249

Watford Dealers' List

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Alpha Microtec Ltd, 321 Stratford Road, Shirley, Solihull, West Midlands. Tel: 021-745 8998.

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*Velobyte, Scheaedyksadyk 5a-6a, 3011 EB Rotterdam, Holland, Tel: (010) 413 8197/414 5171.

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NEW

EIZO 14" Flexscan 80605

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(For full details read the review in this issue of The Micro User).

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- CM8833 14" Med. Res Colour Monitor **£219**

STAR BUY

- **PHILLIPS 14"** Medium Res, dark glass, attractively finished Colour Monitor – supplied complete with RGB, SKART and Audio/Phono Inputs. A push-button switch toggles between Hi-Res monochrome green text mode and full colour display. Has Composite Video Input. (Please state the type of Connecting Lead you require).

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AMBER MONITOR

BT MERLIN/Acorn 12" Hi resolution Amber monitor. Ideal for wordprocessing. Consealed front panel mounted controls. Illuminated mains on/off rocker switch. Supplied complete with BBC Cable.

Only £49

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A range of IBM PC Compatible monitors, both monochrome & Colour are now available. Please write in for our descriptive PC brochure.

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BNC Lead for Zenith or Philips	**£3**
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RGB lead for TAXAN Monitors	**£3**
Archimedes Colour Monitor Lead	**£7.50**

By placing your monitor on one of our professional swivel bases (see monitors drawing on the left), you gain the freedom to adjust the monitor viewing angle to suit your needs and thus alleviate eye strain and reduce back stress. The front mounted adjustable control dial makes adjusting the monitor viewing angle very simple.

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Anti-Glare VDU Screen

These extremely effective, easy to install, 12" & 14" VDU screens eliminate harmful glare, improves contrast on colour monitors. Increases productivity in offices. A must for all wordprocessor users. Hundreds of these screens are in daily use in various branches of one of the leading High Street banks.

£12

TAXAN KP-815 PRINTER

80 column, Bi-directional, 160 CPS, (NLQ 24cps); Friction & tractor feed + paper roll holder as standard; Epson FX compatible.

Offer Price £155

Taxan KP915 132 Column Printerr (carr £7)	**£275**
RS232 Interface	**£49**
RS232 Interface with 2K Buffer	**£69**
RS232 Interface with 16K Buffer	**£89**

Panasonic KX-P1081

Attractively finished in BBC beige. Bi-directional, logic seeking. Has IBM and Epson RX compatible command calls. Speed: 120CPS draft mode, 24 CPS NLQ mode. Character width range from 5 cpi to 17 cpi. Upto 40 downloadable characters. Functions include, Proportional spacing, Justification, centering and left & right ranging.

(Price inludes, FREE a 4ft Printer Lead, and a Dump Out 3, Screen Dump ROM worth £35 with every printer purchased from us).

Special Price: **£145** (carr. £6)

Optional RS232 Interface: **£39**

Panasonic KX-P3131 Daisy-Wheel Printer

Low-cost, high performance; Bi-directional, Logic seeking, Proportional spacing, 10, 12 & 15 CPI, Speed 17CPS. 6K Buffer.

Only **£255** (carr. £7)

Tractor Feed	**£90**
Daisy Wheel (various)	**£12**
Ribbons: Standard **£4.50**; Long Life **£7**	
Extra 32K Printer Buffer (internally fitted)	**£13**

RS-232 GENDER CHANGERS

Male to Female	**£4.95**
Female to Male	**£4.95**
Male to Female	**£4.95**

Panasonic KX-P4450 LASER PRINTER

Latest technology at affordable price. Prints 11 pages a minute, Two A4 size paper bins, Serial & Parallel ports, 512K Buffer – expandable to 1.5Meg, 15 Character LCD Display, Diablo 630, Epson FX-286, IBM Proprinter, HP Laserjet emulations, 5K pages per month duty cycle.

ONLY £1,625

Toner for KX-P4450 **£29**

NEC P2200 PINWRITER

24 pin; 80 column; 168CPS – 56CPS LQ; Epson LQ compatible, 7K Buffer; 7 resident FONTS, Friction & Tractor feed, front load single sheet feed, etc.

Price: £269

FREE Price includes a Free BBC Cable.

Cut Sheet Feeder	**£59**
Pinwriter Serial Interface	**£55**
Additional Font Cartridge	**£25**
NEC P2200 Pinwriter Ribbon	**£6**

NEC PINWRITER P6/P7 Plus

The Ultimate matrix Printer for Business.

24pin printhead; Print speed, 265cps Draft, 90cps LQ; Inbuilt Tractor & Friction feed; A paper park & low tear facility; 20 inbuilt FONTs; A font cartridge facility; 8K of printer buffer; colour option available.

P6 Plus 80 columns	**£439**
P7 Plus 136 columns	**£575**
Cut Sheet Feeder	**£125**
Colour Option	**£74**
Serial Interface	**£73**

EPSON PRINTERS

EX800	**£405**	LQ850	**£430**
EX1000	**£545**	LQ1050	**£589**
FX850	**£315**	LQ2550	**£839**
FX1000	**£425**	LX800	**£175**
GQ3500 Laser	**£1249**	SQ2500	**£975**
LQ500	**£285**		

Star LC10 £175 **LC10 Colour £225**

PLOTTERS

Hitachi 672 Colour Plotter	**£475**
Plotmate Plotter A4S	**£379**
Plotmate Plotter A3M	**£549**

CUT SHEET FEEDERS for
EX800 **£149**; EX1000/LQ2550 **£210**; FX800 **£149**; FX1000 **£179**; LQ/LX800 **£139**; LQ500 **£75**; LQ850 **£135**; LQ1050 **£175**.

TRACTOR FEED for
EX800/1000 **£85**; LQ800 **£44**; LQ850 **£69**; LQ1050 **£85**; LQ2500 **£195**

ACCESSORIES

- EX800/1000 Colour Option **£55**
- EX800/1000 Colour Ribbon **£18**
- LQ2500 Colour Option **£65**

(Securicor Carriage on Printers £7

EPSON PRINTER INTERFACES

All these interfaces fit inside the printer.

RS232	**£32**	RS232 + 2K Buffer	**£52**
IEEE 488	**£40**	RS232 + 8K Buffer	**£79**

Universal Printer Sharers/Changers

Connect upto 5 Micros to 1 printer or 5 Printers to 1 Micro with our combined, Sharer/Changer. These Units are made to a very high standard. For extreme reliability, they all have Printed Circuit Boards mounted inside the case, (not a Spagetti Junction of wires). Internal connection is made via high quality ribbon cables.

(Ideal for School environments.)

Connects	Serial	Centronics
2 to 1	£22	£23
3 to 1	£30	£32
5 to 1	£40	£42

(Cables extra at £6 each. Please specify type required when ordering)

INTEGREX COLOUR JET PRINTER

- Colour Jet 132 Printer **£515**
- Paper Roll **£6**
- Screen Dump Software **£10**
- Colour Cartridge **£14**
- Black Cartridge **£8**
- 100 A4 OHP transparencies **£55**
- 8K Serial Interface Optional **£99**

Professional Printer Stand

This new professional printer stand takes hardly more space than your printer. Due to the positioning of the paper feed and re-fold compartments ie. one above the other, the desk space required for your printer functions is effectively halved. Additional facilities include: Easy access to paper from both sides, used with both top and bottom feed paper and with its dial controlled paper feed system with adjustable deflector plates it ensures smooth paper flow and automatic refolding.

80 Column version £23 (carr. £2.50)
132 Column version £26 (carr. £2.50)

PRINTER LEADS

BBC Centronics 4' long	**£5**
BBC Centronics 6' extra long	**£7**
Compact's Special Centronics Lead	**£7**
Archimedes Printer Lead 1 meter	**£7**
IBM Parallel Lead 1 meter	**£7**
Double Ended 36 way Centronic Lead	**£9**
RS232 Leads (Various)	**P.O.A.**

PRINTER RIBBONS & VARIOUS DUST COVERS

Type	Ribbons	Dust Covers
BBC Micro	–	**£3.50**
BBC Master	–	**£4.00**
Archimedes Micro pair	–	**£9.00**
IBM PCs pair	–	**£6.00**
Brother HR15/20	**£3.00**	**£5.00**
DMP2000	**£3.75**	**£4.75**
EX/LQ800	**£4.50**	**£4.50**
EX/LQ1000	**£7.50**	**£5.00**
RX/FX80/85/800/MX80	**£3.90**	**£4.95**
RX/FX100/1000	**£5.75**	–
Kaga/Taxan KP810/815	**£4.90**	**£4.00**
LC10 (Black)	**£4.25**	**£5.00**
LQ500/800	**£3.75**	**£5.00**
LQ1050/LQ2500	**£8.50**	**£5.50**
LX80/86/800	**£3.80**	**£4.50**
M1009/GLP	**£3.80**	**£3.75**
Panasonic KX1080/81	**£4.00**	**£4.75**
SQ2500	**£23.00**	**£5.50**
Star NL10	**£3.75**	**£4.50**
Olivetti Ink Jet Cartridges (set of 4)	**£9**	

Our attractive Dust Covers are manufactured from translucent PVC. The seams are stitched and edges are taped to prevent splitting due to continuous use.

Listing Paper (Perforated)

- *1,000 Sheets 9½" × 11" Fanfold Paper* **£7**
- *2,000 Sheets 9½" × 11" Fanfold Paper* **£12**
- *1000 Sheets 9½" x 11" NCR 2 Part Fanfold* **£19**
- *1,000 Sheets 15" × 11" Fanfold Paper* **£9**
- *1000 Sheets true A4 Fanfold Paper* **£11**
- *2000 Sheets true A4 Fanfold Paper* **£19**
- *Teleprinter Roll (Econo paper)* **£4**

(All our Fanfold paper is Micro perforated leaving a smooth clean edge when the tractor feed strips are detached):

Carriage 1K Sheets £2.50. 2K Sheets £3.00

PRINTER LABELS

(On continuous fanfold backing sheet)

1,000 90 × 36mm (Single Row)	***£5.00***
1,000 90 × 36mm (Twin Row)	***£4.90***
1,000 90 × 49mm (Twin Row)	***£7.50***
1,000 102 × 36mm (Twin Row)	***£6.25***

Carriage on 1,000 Labels £1.00

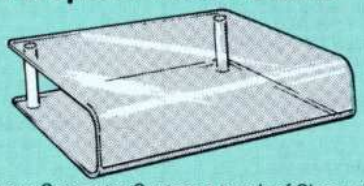
PLINTHS FOR BBC MICRO, MASTER & PRINTERS

Protect your computer from the heat of your VDU. Our micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and VDU, whilst the double height version provides enough room for our stacked disc drive and other peripherals like, Eprom programmer, music unit or simply discs & stationary. The computer slides neatly in the lower section allowing easy access to remove the lid.

The single printer stand is equally sturdy but instead of cooling slots it has elegant cutouts on the sides. This allows easy access to paper from all sides. Colour: BBC Beige.

Single BBC Plinth	**£12** (carr. £2)
Double BBc Plinth	**£20** (carr. £3)
Printer Plinth	**£12** (carr. £2)
Single Master Plinth	**£13** (carr £2)
Double Master Plinth	**£24** (carr £3)

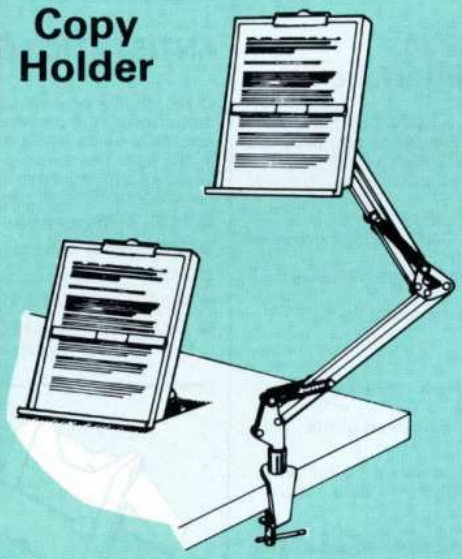
Perspex Printer Stand



Give your Computer System a touch of Class with our elegant, smoke finished Perspex Printer stand. The printer sits on top and the fanfold paper rests neatly underneath, thus occupying the same space as the printer footprint.

Only: £16 (carr. £3)

Copy Holder



Whether you want to type in your latest program or the draft of a new trilogy, Watford's manuscript holders are superb for holding your paper at the ideal height and angle to allow you to read and type in ease and comfort.

Available in 2 full A4 versions, desk resting and shelf clamping. Paper is held firmly by means of a plastic retaining ruler and a clip grip. (for resting books or magazines, the desk top version is recommended).

Desk Top **£10** (carr. £2)

Angle poise **£14** (carr. £3)

MEGABUFFER 256

The Smallest 256K Printer Buffer Unit in the world **38mm x 130mm x 134mm.**

This new Megabuffer 256 from Watford is a full featured 256K Printer Buffer. It allows the computer to print 256,000 character in a short time thus freeing the computer very quickly. In short it makes light work of printing large documents, screen dumps, etc. It is extremely simple to connect. The features are:

- Improves efficiency by making more efficient use of computer and printer.
- Compatible with any computer and printer that uses Centronics Parallel connections including all BBCs, IBM PCs, etc.
- Total compatibility with all software.
- Cheaper phone bills when using your Modems.
- Ideal for those doing large graphics screen dumps that are slow to print.
- Multi-Copy facility allows you to print several copies via Megabuffer without going through your computer.
- Data Dump facility is included.
- Built in test unit for both the buffer & your printer.

In conclusion it can safely be said that MEGABUFFER 256 is the ultimate printer Buffer for both the amateur and professional user.

Only £149 (carr £2)

OKIMATE COLOUR PRINTER

The first ribbon transfer printer in its price range which offers fully versatile colour or black printing. A 24 element print head produces more than 100 shades with exceptional clarity. Ideal for use with Quest Paint or AMX Super Art.

Only: **£119**

BBC Screen Dump	**£10**
Colour Ribbon	**£6**
Black Ribbon	**£6**

THE EPSON RX-FX-KAGA PRINTER COMMANDS REVEALED

So you bought yourself a new printer, because the salesman in the shop showed you how clever it is and impressed you with all sorts of printouts to show its capabilities – he may even have offered you a special price.

However, now that you have got it home and connected it to your BBC microcomputer, you are wondering how to make it perform these magical tasks. The manual seems to give no clues, and when you type in the example programs, the computer throws the LPRINT statements back in your face.

Now what do you do, when this £400 piece of high technology refuses even to move its head, and you have stayed up until 2 in the morning with copious supplies of coffee, desperately trying to print something out. Once again, Watford Electronics comes to your help with our new book entitled 'THE EPSON FX-KAGA PRINTER COMMANDS REVEALED'.

This book describes in plain, easy to understand English, how to use and make the most of your KP810, PW1080A or any other Epson FX80 compatible Printers like Panasonic KX-P1080/1, etc., with the BBC Micro, both from BASIC and Wordwise.

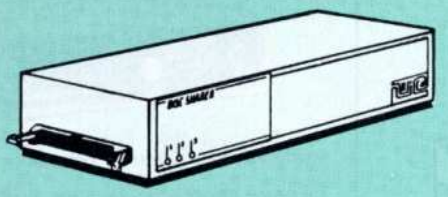
It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

£5.95 (No VAT)

CREDIT CARD 24 HOUR
Ansaphone Hot Lines
(0923) 50234 or 33383

Continued

DISC DRIVE SHARER



(Ideal for educational establishments)

At last, a low cost alternative to the Econet system. Watford's Intelligent Disc Drive Sharer allows you to connect 3 BBC micros (model B, B+ and Master series) to a single or double disc drive. Running under any DFS or DDFS, this intelligent unit will automatically queue the computers. Each computer has a status light dedicated to it. If it is green you will get immediate access to the disk, and red means that you are next in line. The unit plugs directly into the disc drive socket on each computer and is powered by the mains. (N.B. Not for use with ADFS.)

Launch Price: **£65** Price includes 3 Cables

NOW WITH EXTRA FEATURES AT NO EXTRA COST – Watford's latest DFS 1.44

- Incorporates Acorn's Official Tube Host Code so that those with 2nd processors no longer need to waste a ROM socket on the DNFS.
- Option to DOUBLE the speed of BPUT and BGET.

WATFORD's & ACORN's SINGLE DENSITY DFS

Watford's popular and widely acclaimed DFS has now been available for six years and has gained a large following amongst serious and educational users of the BBC Micro. Owners of Acorn or any other standard DFS can upgrade to our "Ultimate" DFS merely by replacing their DFS ROM. See below for this upgrade. ***(P.S. Watford's highly sophisticated DFS is fully compatible with Acorn standard DFS). (while Acorn's 1770 DFS is fully compatible with Watford's Mk II DDFS)***

- *Complete Disc Interface Kit including DFS ROM and fitting instructions* **£48**
- *Acorn's 0.90 DFS Kit complete* **£49**
- *DFS Manual (Comprehensive)* *(no VAT)* **£6.95**

(P.S. Our DFS manual is the only comprehensive Manual available for the BBC micro and covers both Acorn & Watford DFSs).

- *Watford's sophisticated DFS ROM only* **£16**
- *We will exchange your existing DFS ROM for Watford's Ultimate DFS ROM for only* **£12**
- *DNFS ROM only* **£17** • *ADFS ROM only* **£25**

NEW

Watford's MkII 1770 Double Density DFS Interface

Many of our customers have wanted to use our superior DDFS and Acorn ADFS together. Now our Mk II DDFS Board with its 1770 Disc Controller, has been adapted to allow the use of Acorn ADFS as well. It also has all the commands of the Acorn's 1770 DFS, plus the added features:

Added features include:

- Acorn ADFS compatible – Use ADFS on our DDFS board.
- Tube host Code – No longer any need to have the DNFS in your machine to use Co-Processors, even the CoPro and Master 512.
- Auto 40-80 Track sensing – no need to fuss with 40/80 track switches (even works with protected disks).
- An extremely powerful 8271 emulation – ensuring compatibility with almost all software.
- New low profile – small footprint board.
- Fits with all third party ROM boards.
- Option to double the speed of file handling operations – BPUT and BGET.
- Operates in both single and double density modes.
- OSGBPB has been recoded, increasing still further the speed of file handling.

Please note that not all DDFS's are capable of providing either the full 80% storage increase or of allowing a file the full size of the disk – Ours allows both of these!

If you already have a DDFS (any manufacturer), and wish to upgrade to our MkII version, then simply return your existing ROM and DDFS board and we will supply the new DDFS for only **£30.00**.

- Special introductory offer **£39.00**
- DDFS Manual (No VAT) **£6.95**
- We will exchange your existing DFS Kit for our sophisticated DDFS for only **£25.00**

Please note, as the MkII DDFS is a hardware and software upgrade, it is not possible for existing Watford DDFS users to simply exchange their ROM for the new version.

DUST COVERS (For our Disc Drives)

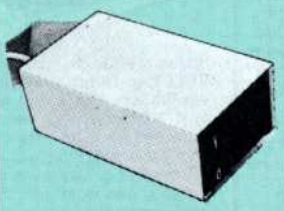
Single CLS (without PSU) **£3.20** Twin CLD (without PSU) **£3.85**
Single CS (with PSU) **£3.95** Twin CD (with PSU) **£3.90**

Special 40/80 Disc Drive/DDFS Mk II Offer

- The popular 40/80 track 400K single Disc Drive, Double Sided, cased with Cables. Plugs directly to your Micro.
- Watford's extremely popular DDFS Disc Interface (allows 720K storage). Will run in both, Single & Double Density modes.
- A comprehensive User Friendly Manual.

A Bargain at Only **£125** (£6 carr)
(Offer valid while stocks last)

3½" DISC DRIVE OFFER



These top quality 3½" Double sided, 80 track, 1 Megabyte (unformatted each Disc Drives), are attractively finished in BBC beige. They are supplied complete with all cables and a Utilities Disc. They run directly from the BBC B/Master's own PSU.

- **CLS35 400K Unit** **£69**
- **CLD35 800K Unit** **£126**

Mysteries of Disc Drives & DFS Revealed

Are you tired of faulty cassettes, and lengthy loading times? Do you want to upgrade your BBC micro to take discs but you get tied up in the plethora of jargon surrounding the choice and use of these systems.

Then The Mysteries of Disc Drives and DFS Revealed is the book for you. It explains in detail the different types of systems available, how they are installed and how to use them. Many examples are given including pre-written programs to call various functions of the DFS available only through Operating System calls. Different types of disc, 40/80 tracks etc. are all explained. This book is ideal for the beginner confused by the plethora of choice available in the marketplace.

£5.95 (Book No VAT)

DISC ALBUMS

Attractively finished in black leather look vinyl. Stores upto 20 Discs. Each disc can be seen through the clear view pocket.

£4

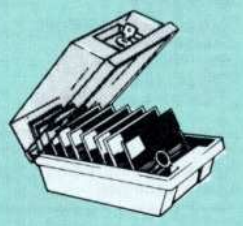
FLOPPY HEAD CLEANER KIT

The heads in floppy drives are precision made and very sensitive to dirt. The use of a cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. It is very simple to use. Available in 3½" & 5¼", please specify.

£4

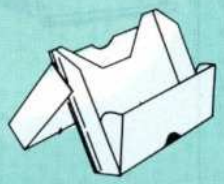
ANTISTATIC LOCKABLE DISC STORAGE UNITS

Gives double protection – Strong plastic case that affords real protection to your discs. Antistatic helps avoid data corruption whilst in storage. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.



- **M35** - holds upto 50 5¼" discs **£5.00**
- **M85** – holds upto 95 5¼" discs **£8.00**
- **M25*** – holds upto 25 3 ½" Discs **£5.50**
- **M50** – holds 50 3½" Discs **£7.50**
- **M10** – holds upto 10 Data Cartridges **£15**

* Not lockable



PLASTIC LIBRARY CASES

Holds up to 10 5¼" Discs. **Only £2.00**

DISC PLONKER RACK

When using ones micro, there is a tendancy to have more than one Disc on the desk. This exposes them to the hazards of fingerprints, scratches, dust, coffee and an untidy desk.

Why not protect your valuable data from all these hazards with the help of our extremely handy and low cost DISC PLONKER RACK. It holds up to eight 5¼" Discs.

Protection at Only: **£2**

Quality Disc Drives from Watford

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.

The first capacity given in the first column indicates capacity in single density mode. That within the brackets is the capacity in double density mode. All disc drive type numbers start with the prefix "C".

The tinting on some of the boxes is used to indicate which Drives are 40 track (non-tinted) and which are 80 track (tinted). All our 80 track drives are already fitted with a 40-80 select switch.

***All our Disc Drives are Double Sided and will operate in both Single and Double Density modes.** Extensive experience of the usage of disc drives suggests that the JAPANESE drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.*

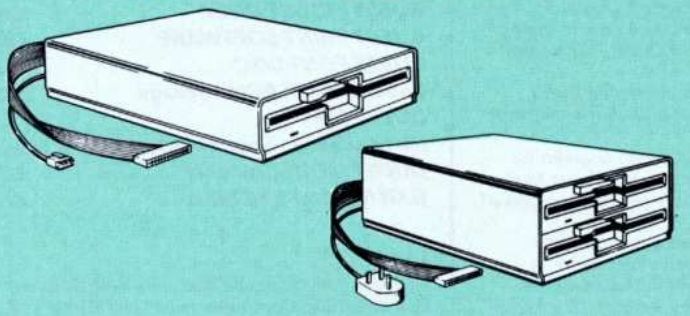
Various UK "manufacturers" of disc drives for the BBC micro (more accurately, "packages" label other manufacturers drives with their own name). We buy the high quality NEC and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.

If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.

Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate (extensive tests within our workshops have confirmed this). All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. Ideal for Schools & Colleges. We are now able to supply all single disc drives with Power Supply, in either single or dual case. (Dual case has a twin data cable and a power supply capable of driving two disc drives) allows easy expansion to a dual drive unit, at a later date. Prices stated in the pricing boxes below are for single drives in standard single cases. Single drives in a dual case cost an extra £5. (At Watford we anticipate your needs of tomorrow, not just today)!

When using a BBC Micro, most people find themselves short of desk space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space) your BBC, Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with Watford plinth. (Turn to the 5th page of our advert for the Plinths).
P.S. All our 5¼" Disc Drives with PSU are compatible with the Compact Micro. All you require is the special Compact Disc Drive Cables designed by us.

Our Disc Drives conform to BS415



Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
200K (360K)	CLS 200 £89		CS 200 £98	
400K (720K)	CLS400S £82	CLD 400 £168	CS 400S £92	CD400 £188
800K (1.44M)		CLD 800S £162		CD 800S £182

● TWIN Disc Drive Case, complete with Power Supply & Cables **£43**
Securicor carriage on Disc Drives £5 to £6

Prefix ***C*** *= Cased Drive*
L *= Less PSU*
S *= Single*
D *= Double*

Suffix ***S*** *= 40-80 Switchable*

e.g. CLS400S = Cased Disc Drive, Less power supply unit, single 5¼" 400K, (720K in double density); Double sided; 40/80 track switchable.

Cable to connect 5¼" Disc Drives to BBC Compact
Single £9 Twin £12
Special Cable to connect both 3½" and 5¼" Disc Drives simultaneously to the BBC Compact £13

3M – DISKETTES

3M – SCOTCH Diskettes with Lifetime warranty from Watford Electronics your 3M Appointed Distributor.

- *10 × 5¼" S/S D/D 40 Track Diskettes (744)* ***£6.00***
- *10 × 5¼" D/S D/D 40 Track Diskettes (745)* ***£7.50***
- *10 × 5¼" S/S D/D 80 Track Diskettes (746)* ***£11.50***
- *10 × 5¼" D/S D/D 80 Track Diskettes (747)* ***£11.00***
- *10 × 5¼" 1.6M D/S D/D High Density Discs for IBM XT and AT* ***£19***
- *10 × 3½" S/S D/D 40/80 track Discs* ***£10.00***
- *10 × 3½" D/S D/D 40/80 track Discs* ***£11.75***
- *10 × 3½" High Density Diskettes* ***£35***

TOP QUALITY 3½" & 5¼" DISKETTES

To complement our range of Quality Discs and Disc Drives, WE are now supplying SPECIAL OFFER packs of 10 Lifetime guaranteed discs. Each disc has a reinforced hub ring. Supplied complete with selfstick labels and a Plastic Library Disc Box.

- *10 × **M3** 3½" D/S D/D 80 Track Discs* ***£11***
- *10 × **M9** 3½" Double Side High Density* ***£34***
- *10 × **M4** 5¼" S/S D/D 40 Track Discs* ***£5***
- *10 × **M5** 5¼" D/S D/D 40 Track Discs* ***£7***
- *10 × **M7** 5¼" D/S D/D 80 Track Discs* ***£9***
- **10 × M8 5¼" D/S H/D Hi-Density Discs** **£14**
- *3" Double Sided Discs* ***£2.50*** *each*

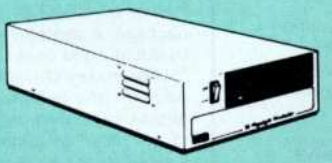
Special BULK OFFER on 5¼" DISCS

PRICES SLASHED

(Supplied packed in Anti-Static Lockable Storage Units)
(Lifetime warranty on Discs)

BULK PACK DISCS in lots of 100

Type	S-S 40T	D-S 40T	D-S 80T
● Without Sleeves	£35	£39	£45
● With Sleeves	£38	£42	£48



WATFORD's WINCHESTER DRIVES

Undoubtedly the best value for money Winchester Hard disc available anywhere for the BBC Micro.

This 30 Megabyte hard disc is completely compatible with the Acorn ADFS – that's why we have bundled it with each Winchester drive, along with a Utilities Disc.

Finished in rugged metal and fetching BBC beige, the Winchester has an internal fan, so quiet you won't even hear it! A switched mode power supply and a neon-lit on/off switch are there along with a light on the hard disc to tell you when it is working – just compare the price with our competitors' 20 or 28 Mbyte discs!

Compatible with the Master, and the BBc B (with 17 X disc interface).

● 10 Megabyte **£350;** ● 30 Megabyte **£420**

CDP800S **CDPM800S**

Twin 800K Double sided 40-80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC Micro. Supplied complete with integral power supply, cables and Utilities disc. The mains switch with neon On/Off light indicator, and the two 40/80 track switches are mounted on the front panel for ease of use.

CDP 800S for BBC Micro £192
CDPM 800S for Master £196
DP35-800 for BBC/Master £165
(For DP35-800S spec. see Page 9 of our advert)

(Securicor Carr. £7)

(The above drive units are 2 Megabytes unformatted)

Continued

NOMINATED FOR BRITISH MICRO COMPUTING AWARDS 1987

QUEST MOUSE

The ultimate in Mouse technology, the Watford Electronics Quest Mouse must be the most powerful Mouse package yet produced for the BBC Micro. Featuring state of the art 32K ROM software the Quest Mouse package is filled with features essential to the budding artist. The Quest Mouse is a high precision, low profile and large footprint mouse. It has three large comfortable buttons and its RUBBER COATED STEEL BALL is smooth and easy to use on virtually any work surface. This also eliminates any directional bias that one encounters on the most well-known mouse for the BBC. The Quest Mouse is FULLY HARDWARE COMPATIBLE with the AMX MOUSE so that it will work with any of the AMX range of software.

The two parts of the Quest package are available separately so that existing Mouse owners can upgrade to the Watford's sophisticated Quest Paint software or replace their existing worn out mice for a minimum cost.

QUEST PAINT

The Quest Mouse software is supplied on a PALPROM unit to allow the sophisticated 32K program to be used from a single ROM socket. It is compatible with the BBC B, BBC B Plus and BBC Master Series machines.

The software is used to draw high resolution Mode 1 pictures in full colour. All menu selection and control of the drawing process is performed with the mouse so that you will hardly ever touch the keyboard.

SOFTWARE FEATURES

The software is far too powerful for us to describe it fully in such a small space. Below is a list of the various features. Please write to us for a fully descriptive leaflet.

Disk interface not required. Utilities disk has facility to create and print big screens. Colours applied can be solid, either pattern of user defined pattern. Drawing can use brush or airbrush. Brush shapes can be defined and stored. Airbrush sprays colour/pattern randomly with four jet sizes and even or center spread. Colour cycles. Colour protection to stop particular colours from being overwritten by selected drawing actions. All standard drawing facilities like: rubber, straight pencil lines, triangles, circles, ellipses, rectangles, parallelograms, polygons, etc are provided. All shapes can be solid or just a boundary line. Once a shape has been set up it can be repeated anywhere on the screen. Global colour replace in a rectangle. Powerful fill facility for areas and vertical/horizontal lines. Full cut and paste of rectangular areas with rotation and size with screens from Watford Beeb Video digitiser. Load and Save screens with colour pallet information, save brush and pattern definitions etc.

Take The Guesswork Out of Selecting a Mouse Package

With reviews like this how can you go wrong.

Popular Computing Weekly, 9-11 June '87
"What you actually get for your money is a well built, three button mouse (far superior to the AMX mouse)."
"Overall the combination of a quality mouse and decent art package gives Watford Electronics a real chance of supplanting AMX as mouse supremos."

Micro User June '87
"Quest Mouse and Quest Paint can hold their heads high in the market. . ."

A&B Computing June '87
". . . Watford Electronics, a company famed for excellent hardware add ons and versatile software packages. Called Quest mouse, "this is a very special mouse driven drawing package..."
". . . you will have one of the most comfortable and professionally built mice I have used in a long time. The buttons are responsive, the mouse movement is smooth and without directional bias – a pleasure to use."
"What we have here is probably the best art package there is for the BBC Micro . . ."
"Quest Paint is a major leap forward in BBC programming. . ."
"Quest Paint is an original piece of programming, it is friendly and well endowed with many useful facilities. I would comfortably say it is easier to draw good pictures with Quest Paint than it is with more expensive 'Professional' art packages for the Atari ST and the Commodore Amiga. A recommended buy if you are looking for the best in BBC micro based art packages".

Acorn User, September '87
"The mouse (Quest) performs well in the face of competition from AMX, Wigmore and the rest . . ."
". . . this package represents excellent value for money. If you are interested in art then this program is for you to buy".
"Given time, I can see no reason why Quest Paint shouldn't take on the title of the definitive art package available for the BBC Micro to date".
"All in all, Quest Paint is a very professional package. It contains virtually every feature the budding artist could require".
"What makes Quest Paint so versatile is the addition of a sub-menu which allows you extensive control over each function".
"Until recently, Superart from AMS had been judged as the definitive mode 1 graphics package for the BBC micro. But now it has a serious rival in the form of Quest Paint, from Watford".
"As a measure of what is contained within Quest Paint, I would say it had all the features of Superart plus . . ."
"In most art packages, provision is given for drawing triangles and rectangles. Quest Mouse goes 14 better, allowing any regular polygon of upto 16 sides".
"One facility, not found on any other Art package to my knowledge, is the ability to access a digitiser from within the program".
The reviewer concludes by saying, "The result is an extremely comprehensive and professional art package".

John Kilby, Head of Computer Science, Bishop Wulstan High School, Rugby, writes:
"Quest has been an excellent piece of equipment. The problem that seems to occur everyday is that at lunchtime the pupils rush to the computer room to make sure that they are first in the queue for the 'Quest' mouse".

Lt. Col. C.G. Holton, HQ 1 (BR) Corps, BFPO 39, writes:
"As ever your service is superb and the Quest Mouse proves every bit as good as the adverts claim".

Beeblet User Group, New Zealand Oct '87:
"One of its nicer features is that the top menu is done in Mode 0, the drawing itself is in Mode 1. Thus on screen together are two different Modes. A neat way around an old problem".

"PAN is used when a larger than one screen size image is required. The mind boggles at an A3 size drawing".

"I like it partly because of the mouse itself which is smooth and easy to handle but mainly I suppose because of the features I longed for and previously never got. Its easy to use with almost everything at your fingertips from the mouse. The software is simple where needed and complex where complexity is required".

ConQuest

Watford's Quest package is an extremely powerful and flexible drawing package, with very wide and unusual features. However, since its launch various suggestions for even more advanced & powerful facilities were received from the Quest users. ConQuest allows you these more advanced facilities, like, distortion of a cutout to any shape and a full font designer. If you also have a GXR ROM in your machine or you are using a BBC Master then ConQuest will take advantage of this to give ellipses at any angle, sectors and arcs, etc. Quest combined with ConQuest and Acornsoft GXR ROM make up THE MOST POWERFUL drawing packages available for the BBC range. Quest Paint is able to take advantage of almost any additions to your machine, such as Shadow or Sideways RAM. ConQuest takes this principal even further, by utilising the otherwise normally incompatible Sideways RAM facility by holding pictures in them.
Some of the features are:

- *Pick filenames off the screen for loading and saving.*
- *Rotate a cutout to any angle and Distort it to any four sided shape.*
- *Has Built in Font editor.*
- *Default brushes and patterns on startup.*
- *16 x 16 font available on start up.*
- *Ability to reset patterns, fonts and brushes to default at any time.*
- *ROM based enhanced Epson and compatible printer dump.*
- *ROM based enhanced extended picture routine.*
- *Ability to create and abort extended pictures.*
- *Improved disk access speed for extended pictures.*
- *User definable sideways RAM driver for incompatible sideways RAM systems.*
- *Ellipses at any angle on Master 128 (or B with GXR ROM).*

QUEST MOUSE & QUEST PAINT	**£49**
QUEST MOUSE, QUEST PAINT, AMX PAGEMAKER & PAGEFONT	**£82**
QUEST MOUSE ONLY	**£25**
QUEST PAINT SOFTWARE	**£32**
QUEST FONT DISC	**£12**
ConQuest 32K ROM Package	**£29**
QUEST MAT	**£3**
Part-exchange your old Mouse for a New QUEST MOUSE for only	**£23**
GXR ROM for BBC Micro	**£22**

N.B.
1. Quest Paint supplied complete with Software in a 32K ROM, Comprehensive User Guide and a Utility Disc.
2. Quest Font Disc has 22 text FONTS for use within Quest Mouse.

MARK II LIGHT PEN

Our Mark II Light Pen is the very latest in light pen technology. It is totally insensitive to local lighting conditions and works with many different monitors. The pen only responds to the High Frequency light produced by your monitor/TV. An LED indicates when valid video data is being produced. A conveniently located switch is also fitted.

Price Only £21
(Price includes FREE software Disc and Operating Manual)

RB2 Marconi Tracker Ball

RB2 (AMX/Quest compatible)	£49
RB2 including Quest Paint	£78

FLEET STREET EDITOR

Software pack for BBC Micro	£33
Software pack for the Master	£39
Software Pack for Compact	£40
Admin Xtra Disc Utility	£13
Walt Disney Disc Utility	£13
Fonts N Graphics Disc Utility	£13

THE NEW Mk III AMX MOUSE

ONLY: £59 Inc. Super Art package
(carr £1.50)
(Please specify for BBC, Master or Compact)

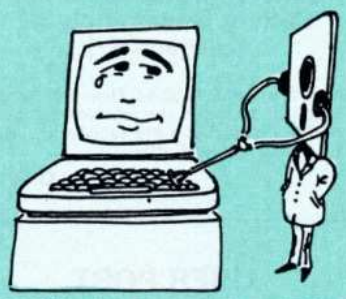
FREE our popular Colour Art software pack worth £15 with every AMX Mouse package purchased from us.

MOUSE MAT	£3
AMX MOUSE ONLY	£29
AMX UTILITY Package	£11
AMX SUPERART Package	£34
AMX STOP PRESS – A Desktop publising software. Works with Keyboard, Joystick or a mouse	£32

We are giving away absolutely FREE, our PAGE-FONT disc with every purchase of STOP PRESS from us.

PAGE-FONTS – Over 20 Fonts for use with AMX Pagemaker	£12
AMX DESIGN (ROM)	£55
AMX XAM Educational	£15
AMX EXTRA EXTRA	£16
AMX MAX A gem of desktop (ROM)	£15

DIAGNOSTICS DISC



The BBC Micro is a very complex machine and thus diagnosing a fault can be very difficult. At Watford Electronics, we realise how difficult it can be when faced with a problem, finding yourself a long way from your nearest dealer, or even just uncertain about your Beeb's health, but not wanting to waste time and money taking it to be looked at.
The solution to these problems is here now, in the form of the Watford's Diagnostics Disc. This excellent utility is specially designed to test out the following areas of your Beeb:
RAMs, ROMs, ULAs, Sound, Keyboard, Disc, RS423, ADC, User Port, Printer Port, Cassette, Joysticks, Speech, Disc Drives, 6502 and Z80 2nd Processors.
This utility is an invaluable aid for all those who take the reliability of their system seriously. A comprehensive manual provides full operating details and a list of possible causes and remedies for any faults that you may find along the way. The package also enables a permanent equipment and service record to be maintained.

Only £20.00

BEEB VIDEO DIGITISER

Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro.

This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket.

Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem.

The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.

Both the black and white levels can be adjusted manually for the optimum picture, or switched to automatic for unattended use. The image produced can be reversed if necessary.

Full controlling software is supplied on a normal sideways ROM and this is easily accessed via additional * commands. The package i designed to allow easy input of complex screens and give full access of the data to the user. Once on the screen, the image can be used as a normal graphics screen, allowing any of the usual graphics commands in BASIC or other ROMs to work on it.

A special print dump routine is included with the driver programs. This is specially designed to produce a fast, correctly proportioned picture, with reduced "contouring", resulting in an accurate reproduction of the original image.

Detailed examples of driving this unit from BASIC or other languages are all provided in the extensive manual supplied.

£109 (Carr. £3)

(Price includes) Digitiser Unit, Software in ROM & a Comprehensive Manual)
(BBC B+ and Master compatible, except Master with Econet)

Magazine Maker

(As seen on TV)
A combination of the Pagemaker and Watford's Beeb Video Digitiser.

Using any video that provides a composite signal and the digitiser, images from a camera or TV can be converted into a graphics screen on the BBC Micro.

They can then be used within Pagemaker to illustrate magazines or newsletters – in fact anything that needs to be created on A4 size paper.

With Pagemaker's many features, a variety of pictures can be composed – the only limit being the imagination.

Pictures can be doctored using Pagemaker's graphics option to produce any number of effects.

Text can be formatted around the digitised photo on screen using the facilities available, which include 16 typefaces, character and pattern definer, text formatting and the ability to load in wordwise and viewfiles plus much more.

Once created the picture can be printed out.

The Magazine Maker is suitable for any use that requires illustrated documents.

Complete Package **£135.00** (carr. £3)

OFFICE MASTER

CASHBOOK – A complete "Stand Alone" accounting software package for the cash based sole trader/partnership business. It is designed to replace your existing cashbook system and will provide you with a computerised system complete to trail balance.

FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.

MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.

EASILEDGER – A management aid software tool designed to run alongside an existing accounting system. Essentially a Debit/Credit ledger system which can handle sales, purchase and nominal ledger routines to provide instant management information.

INVOICES & STATEMENTS – Greatly reduces the time and cost of preparing Invoices and Statements by storing essential information like customer names, addresses and account numbers. Has VAT routines and footer messages facility.

STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details total cost, total stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21** (Disc)

OFFICE MATE

- DATABASE
- BEEBCALC SPREADSHEET
- BEEBPLOT GRAPHICS

DATABASE – Set up a computerised card index system with powerful search facilities.

SPREADSHEET – Offers many calculation and editing features.

BEEBPLOT – Provides visual representation from Spreadsheet data.

OFFICE MATE Only £10 (Disc)

Disc Drives DP35-800S

A Double disc drive – with a difference! Times are changing fast for the floppy disk, and whilst the current standard for the BBC B and Master Series is the 5.25 inch disk, the standard for the future will most certainly be the smaller; faster and more reliable 3.5 inch disks – now a standard feature of both the Master Compact and the Archimedes Series.

To support the present disc drive users, and cope with the future, we have designed our own plinth-mounted disk system – called the DP35 800S, it contains both the 5.25 inch and the 3.5 inch drive formats as well as offer a firm and rigid support for a monitor on top. With the BBC Micro underneath, the plinth makes a surprisingly small footprint on the desk – leaving you more space to work with.

The 5.25" disc drive is 40/80 track switchable. For ease of access, the switches are front mounted. DP35-800S has its own power supply, independent of the BBC Micro.

Watford's new plinth enables users to read, write and format disks both in DFS and ADFS format – currently the accepted standard for the Master Compact and the Archimedes, it also enables the user to read disks written for the Archimedes. Ideal for both BBC & Master.

Launch Offer: **£165** (carr. £7)

Continued

ARIES CORNER

B-32 Shadow RAM Card

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or all 32k as sideways RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Comal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus, Interword and many other applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved *FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as the printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the 6502 processor socket on your BBC micro – no flying leads to connect and no soldering. Provision of the on-board ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Price: **£80** (carr. £2)

Aries B-12 Sideways ROM Board

This board is extremely well made, simple to install, reliable when fully loaded and compatible with the Aries-B20 and the Aries-B32

The B12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on the board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

The B12 system consists of two parts: a large detachable "mother board" which carries the extension ROM sockets and a small "base board" on a short ribbon cable, which plugs into the existing sideways ROM sockets. This two-board design eliminates the reliability problems previously associated with some other ribbon-cable based systems.

If you do not have a B32 or B20, a small adaptor module (the Aries-B12C) is available at a nominal cost.

Price: Aries B-12 **£40**
Aries B-12C **£5**

ARIES B-488 IEEE-488 INTERFACE UNIT

The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB' or 'HP-IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

£238 (Carr £3)

EXTERNAL ROM BOARD for BBC MASTER

This external Beige finished, free standing cased unit with its own Power Supply allows you to plug-in upto 12 ROMs and 16K Sideways RAM.

Only £78

SIDEWAYS ZIF SOCKET

Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

- Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.
- The low profile of the socket allows unrestricted access to the Keyboard.
- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.
- This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for all professionals and Hobbyists alike.)
- BBC, B+ and Master compatible.

ONLY **£16** (carr £2)

Low Profile CARTRIDGE SYSTEM

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack for the BBC B.

- Complete System **£11**
- Spare Cartridges **£2.50**
- Spare Rack **£1.50**

ROM Cartridges for the BBC Master
Twin **£8**; Quad **£12**

16K DISC RAM

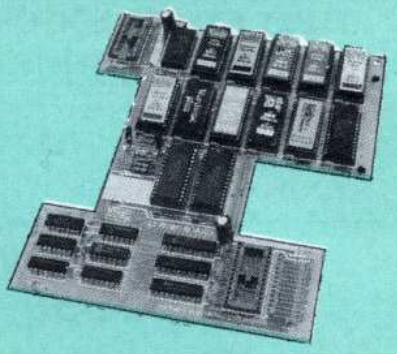
Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

- Write protection (useful in a variety of circumstances).
- Read protection (allows recovery from ROM crashes).
- Compact construction.
- Supplied complete with Battery Backup.
- Multiple units may be fitted, even with a ROM board.
- No overheating or overloading problems.
- Free utilities disc supplied.
- Can be used as a 16K PRINTER BUFFER.
- Ideal for professional software development.
- Supplied with utilities software disc.

Only: **£35** (carr £2)

P.S. 16K Disc Ram Board is not designed to work in conjunction with a Sideways ROM Board.

SOLDERLESS SIDEWAYS ROM SOCKET BOARD



In the May 1986 Micro User's independent review, the writer concludes, "The board has been well laid out. Its position is much better than others – not over the HOT RAM chips and further away from the disc controller area". "I give the solderless ROM board the thumbs up and wish it success".

This brand new board from Watford Electronics is designed specifically for those wishing to add a ROM board to their own BBC without the need to perform any soldering.

This new board expands the total possible number of ROMs in a BBC from 4 to 16.

Unlike our competitors inferior boards, the ONLY upgrade required for fitting battery backup to the Watford Solderless ROM board (all Watford ROM boards, actually) is the fitting of the battery itself. (No other expensive components are required.)

- The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:
- Increase your BBCs capacity for ROMs from 4 to 16.
- **No soldering required.**
- Very low power consumption.
- Minimal space required.
- Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
- Socket 14 takes two 6264 RAM chips.
- Read protect to make RAM "Vanish") allows recovery from ROM crashes.
- Battery backup option for RAM chips.
- Supplied ready to fit with comprehensive instructions.

Price: Only £32
Battery backup fitted **£36**
Battery Backup only **£3**
(carriage £2)

- Sideways RAM Utilities Disc for Solderless ROM Board. Includes the options to load and save ROM Images and the facility to use Sideways RAM as Printer Buffer.

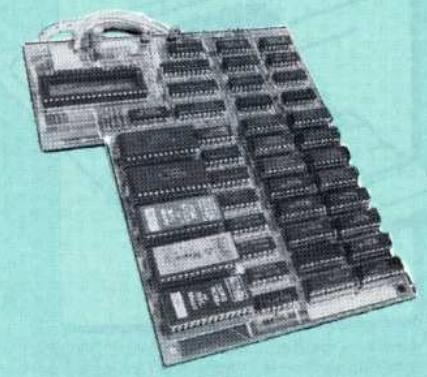
Only: £8

USER PORT SPLITTER UNIT

Gone are the days when you had to plug and unplug devices from the User Port. This extremely useful little device allows two units to be connected to the User Port simultaniously, and select between them simply by toggling a switch. This device is particularly useful for those people using Quest Mouse and the Watford Video Digitiser or any similar combination.

Excellent Value at **£22** (carr £2)

ROM/RAM CARD



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 3 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO overheating problems.
- No User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- Fully buffered for peace of mind.
- Firm mounting in BBC micro.
- Compatible with all BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of Battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- Accepts any ROM.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE Fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROM-SPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM-RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM-RAM Board.

The ROM-RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, for later.

Please write in for further details.

INTRODUCTORY PRICES:

- ROM/RAM card with 32k dynamic RAM ***£48***
- ROM/RAM card with 64k dynamic RAM ***£65***
- ROM/RAM card with a massive 128k dynamic RAM **£109**

(carriage on ROM-RAM Card £3)

OPTIONAL EXTRAS:

- 16k plug-in Static RAM kit.....**£17**
- 16k Dynamic RAM for Upgrade.....**£17.50**
- Battery backup.....**£3**
- Read and Write protect switches.....**£2** each

Complete ROM-RAM board
All options installed **£115**

P.S.
Is your existing ROM Board overflowing with ROMs? Do you need more Sideways RAM? Is your Board unreliable? Then upgrade to Watford ROM/RAM Board and pay £5 less

Le Modem

The MODEM from Watford

At last a professional MODEM for the BBC Micro. Unlike other 'Modem packages' this is a complete package there are no extra software costs to get 'up and running'. Of course Le MODEM is multi-standard, i.e. 300/300, 1200/75 & 75/1200 UK and BELL (USA) are all supported.

The features that make Le MODEM such good value are:

- *A complete communications terminal that transforms your BBC Micro into a very powerful World-wide data transfer system.*
- *Auto Dials, Auto answers, and is completely controlled by your micro. There are no external controls!*
- *Allows you to access PRESTEL, B.T. GOLD, THE SOURCE, MICROLINK, MICRONET, MICROWEB, THE TIMES NETWORK, MICRO LIVE (BBC TV database), CITY BB and more.*
- *Designed to be SIMPLE but SOPHISTICATED. To LOGON to a data base all you have to know is its TELEPHONE NUMBER, Le MODEM does the rest.*
- *Supplied with a comprehensive telecomms package in a 16K sideways ROM which includes a FULL PRESTEL terminal allowing TELE-SOFTWARE to be downloaded.*
- *A comprehensive 80 column terminal. This includes XMODEM error checked transfer protocol, to allow error free data transfer anywhere in the world!*
- *FULLY controlled by simple '*COMMANDS allowing you to control it from your own BASIC programs. To get you started we supply a FREE disc of bundled software!*
- *Connects to the 1MHz bus. A *AUDIO ON-OFF command allows you to actually hear the telephone line through your BBC micro loudspeaker.*
- *Completely self contained with internal mains power supply. (Even a free mains plug is fitted!) A *TEST facility gives ON SCREEN indication that Le MODEM is working correctly.*
- *Packaged in such as way that you need nothing else except a BBC Micro to communicate with computers all over the world.*
- ***FREE Registration to MicroLink.***

SPECIAL OFFER

Price: ***£75***
(carr £3)

(Price includes, Le Modem, Software ROM, Cables & Comprehensive Manual)
(Write in for further details)

REPLICA 3

This new improved REPLICA 3 from Clares is a very powerful disc based TAPE to DISC Utility. It now transfers even more programs than ever before. Replica 3 will not work with all programs but then neither will anything else. 30,000 Replicas have been sold to date. It has to be good.

£15 (40 or 80 track)

Acorn's Speech Synthesiser package, complete
Special Offer £18

APOLLO

The NEW Modem from Watford

Following numerous requests from you, our discerning customers for an APPROVED, Low Cost & High Performance modem with Auto Dial & Auto Answer facilities as standard) we bring you the versatile APOLLO Modem. Just compare the features and look at the price (which incidentally includes the cost of the Software, manual and BBC connecting cable). We are sure you will agree that Watford Electronics in their traditional way are giving you a super 'value for money' deal.

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- Reverse V23 allows User run Viewdata service.
- 1200-1200 half duplex for communications.
- XMODEM, HEX and ASCII file transmission.
- Auto Dial of given 'phone number.
- Auto Answer for User's Bulletin Board.
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- Prestel text screen dump.
- Fully BABT approved.
- **FREE Registration to MicroLink.**

The Apollo is attractively finished in matt black. It opens the doors to world communication to both, the Hobbyist and the Professionals alike. With baud rates varying from 300/300 Originate and Answer, 1200/75 and 75/1200 full duplex and 1200/1200 half duplex, virtually all the popular tele-services can be accessed. A comprehensive Comms ROM oversees the use of the APOLLO, providing simple commands for all the software controlled facilities. APOLLO is an ideal modem for both the first time buyer and the seasoned user. Join the Telecommunications Revolution – Buy a Watford APOLLO!

Only: **£82** **(Carr £3)**

Price includes, the Modem, Comm Software Cables & Operating Manual).
(Write in for full specification)

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The Watford Speech Synthesiser is a very flexible speech synthesis unit based upon the powerful phonemes system. This system stores the building blocks of speech (called phonemes) and allows you to combine them quickly and easily to form virtually any word imaginable.

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Wordwise plus £40

We are giving away absolutely **FREE**, the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
- Chapter marker.
- Epson printer codes function key option.
- Search and display in preview mode.
- Embedded command removal.
- Print Multiple copies of a document.
- Multiple file options for print and preview.
- Address finder.
- Label printer.
- Mail-merger.
- Number/delete/renumber.
- Clear text-segment area.
- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc Interface in your Micro)

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VIEW WORDPROCESSOR 2.1	£35
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DISC Version for BBC B & B+	£14.00
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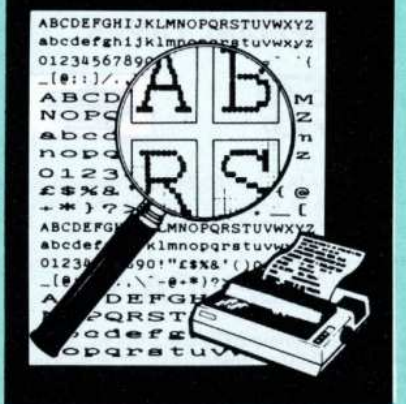
ROM Version	£43.00

(When ordering please specify for which Micro & 40 or 80 track Disc).

EPSON NLQ ROM



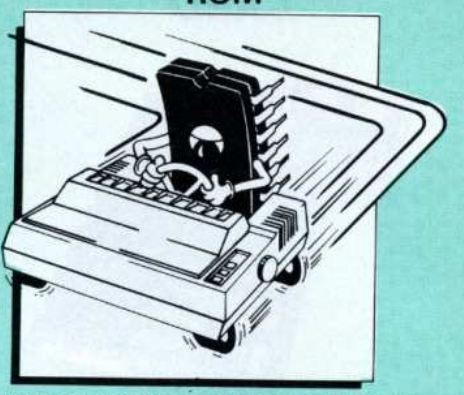
Harness the full potential of your Epson RX or FX printer. The NLQ ROM makes Epson printers produce Near Letter Quality output with optional proportional spacing, enlarged and underlined. Accessed by simple * commands from Basic, Wordwise and View (with driver) or almost any other language.

(Send an SAE for sample printout)

Only: £25

VIEW PRINTER DRIVER for NLQ ROM £7

VIEW PRINTER DRIVER ROM



View is a powerful word processor, but until now has seriously lacked in terms of printer support. With the launch of our Printer Driver ROM, which includes an extremely powerful and easy to use Printer Driver Generator, View users can find themselves in the realms of advanced word processing only at a small outlay.

The VPD extends View's printer command with a series of mnemonic commands. All standard highlight sequences are also supported. A large range of printers are supported by drivers contained within the ROM (the drivers can be downloaded and customised). Printers supported include: Epson's MX, RX, FX, FX, LX, JX80 range, HI80, KP810/910, PW1080, JP101, HR15, M1009, GLP, Panasonic KX-P1081/2, JUKI 6100, etc.

Other printers are readily supported by defining a Printer Driver using the built in Printer Driver Generator. The features mentioned below are available to both the built in Printer Drivers and user defined drivers (assuming the printer supports the features).

NLQ control, Underline, Bold, Proportional Spacing, Microspacing, Italic, Superscript, Subscript, Condensed, Enlarged, Double Strike, Set lines per inch numerically (e.g. LPI 6), Set characters per inch numerically (e.g. CPI 5), Select printer font, Select printer ribbon colour, Translation sequences, Emulation of BBC Character Set, Simple numeric expressions for certain operations, Full printer setup, Send control codes, Print prompt on screen, Redefinable Pad character, Pause for key press, Prompt to change daisywheel, and Execute * command when printing.

Other features include a very powerful on screen preview, with bold, italic, underline, super/subscript, enlarged highlights, and a special printer driver to allow memory based text to be previewed by View 1.4. Of course, View 1.4, 2.1 and 3.0 are all supported, as is Shadow RAM and 6502 Second Processors. The BBC B series and Master series of micros are supported. A comprehensive manual is supplied. All in all, a very professional product for the discerning user who wants power at their finger tips. (Write in for a detailed leaflet).

Price: Only £33

ROM-SPELL

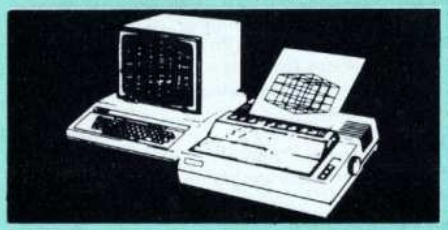
Probably the most advanced and fastest spelling checker available for the BBC Micro. Compatible with View, Wordwise and Wordwise Plus ROMSPELL is simple to use with easy editing of incorrect words. Full facilities for editing the user dictionary to allow customisation to your personal needs. Dictionary includes over 30,000 words and is supplied with a Comprehensive manual.

NOT compatible with 1770 DFS.

(Please state 40 or 80 track dise)

Price still only: £25

DUMPOUT 3



A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including full Mode 7 graphics.
Also provided are window setting utilities and OSWORD calls to plot and read Mode 7 graphics pixels.

Facilities:

- Vertical and horizontal scaling in all graphics modes and mode 7
- Rotation of image by 90, 180 or 270 degrees
- Left hand margin setting
- Screen dump window setting
- Colours appear as grey scale
- Two tone fast dump
- Colour mask
- Mode 7 contrast expansion
- Mode 7 contiguous dump
- Key triggered and User Port triggered dumps

The Micro User Feb. 1985.
'Without reservation I wholeheartedly recommend the Dump Out 3 ROM as the ultimate screen dump facility for the BBC Micro . . . it must represent excellent value for money and surely cannot be beaten".

For use with the following printers:

GLP, GP80/100/250, CANNON, STAR, KAGA/TAXAN, NEC, SHINWA CP80, GEMINI, EPSON MX/RX/FX, M1009, NEC PC8023, DMP100/200/400, Panasonic KX1081/82, Mannesman Tally and compatibles.

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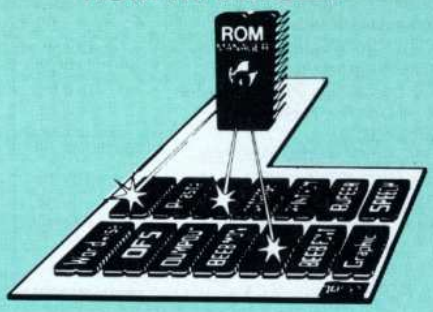
ROM MANAGER



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"Provides comprehensive management of all your installed ROMs". (BEEBUG November '84.)

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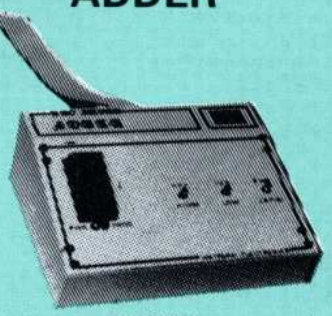
ADDER



The only low cost EPROM Programmer for the BBC Micro that will program both the standard 21V and the new 12V5, 27128 EPROMS.
Adder is the ultimate EPROM programmer for the BBC Micro. It will program many different EPROMs up to the very latest 27256 32K devices.
The Adder unit connects to the User Port and draws its power from there too. The EPROM is mounted in a top quality ZIF socket. There are no switches or controls as Adder is entirely software controlled.
The Adder software provides sophisticated facilities for programming EPROMs from a RAM image produced by loading disc files. The software is menu driven and designed for ease of use.
Features:

- Two ultra fast programming algorithms or standard slow algorithm.
- Supports standard 21V programming and newer 12.5 volt EPROMs. (Software switched).
- The RAM image to be programmed can be built up in many ways. Sections of image can be loaded separately. Part programming. Read EPROM. Edit data in memory.
- Automatic processing to handle a list of files to program into the EPROM.
- Automatic disc buffering to allow programming of 32K 27256 devices from a 32K file without extra effort.
- Verification gives detailed error list and checksums are maintained. There is also a blank check facility.
- Works with all standard filing systems. Generates header code for RFS ROMs to allow Basic programs etc. to be stored in EPROM. More than one file per ROM permitted.
- Programs the following EPROMs: From 2K to 32K: 2516, 2716, 2532, 2732, 2764, 2764A, 27128, 27128A, 27256 (Both 12.5V and 21V).

£75 (£3 Carr)

TEX EPROM ERASERS

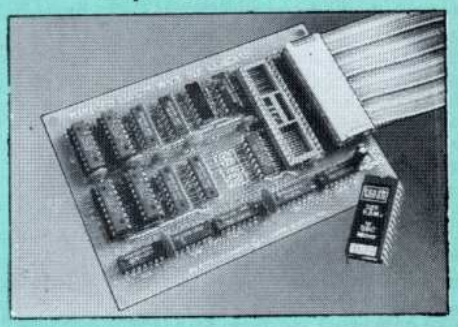
EPROMs need careful treatment if they are to survive their expected lifetime. Over erasure of EPROMs very rapidly turns them into ROMs! The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast. We use these erasers for all our own erasing work.

- **ERASER EB** – Standard version erases up to 16 chips. **£28** (carr £2)
- **ERASER GT** – Deluxe version erases up to 18 chips. Has automatic safety cut-off to switch off the UV lamp when opened. **£30** (carr £2)
- Spare UV tubes. **£9**

32K

SHADOW RAM- Printer Buffer

Expansion Board



A MUST FOR WORD PROCESSING

Watford Electronics now brings you the latest state-of-the-art MEMORY EXPANSION BOARD for your BBC microcomputer. Don't throw away your BBC B for a BBC B Plus or BBC Master. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16K or even 20K, but a massive 32K of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer – type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.

- "VIEW" Wordprocessor users can now type in letters in 80 columns and have up to 28,000 bytes free – 5 times as much as normal.

- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24K of text in memory. This product is recommended as an ideal complement by Computer Concepts.

- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20K of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28K of program space.

- Use the FULL 32K or the bottom 12K of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS423 etc. Print large text files while running long graphics programs, and have all your buffer options available as well (*FX15,21,138,145,ADVAL etc). Please note only a 12K printer buffer can be used with Wordwise or Wordwise-Plus, due to the way they are written.

- Unique facility to turn ROMs off and on again. Unlike all other ROM managers, this feature does not use 'unofficial' memory. Two bytes of normally user-inaccessible memory on the RAM card are used to ensure ROMs are disabled WHERE OTHER ROMS FAIL.

- Recommended by Computer Concepts for use with their Inter series of ROMs.

Only £59 (carr £2)

(Price includes a comprehensive manual and the ROM)

INCREDIBLE WORDPROCESSING DEAL

Watford's 32K SHADOW RAM CARD and Computer Concept's INTERWORD Wordprocessor package.

at Only **£89** (carr £2)

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NEW

The Advanced Reference Manual for the BBC Master

At last Acorn's long awaited Advance Reference Manual for the BBC Master Series of Microcomputers has now been published. Watford Electronics' own authors have edited and added missing sections to the original script and produced a very high quality publication.

It features information about:

- Memory Organisation
- Slow data bus
- Detailed circuit description
- Keyboard controller
- Screen display
- User port
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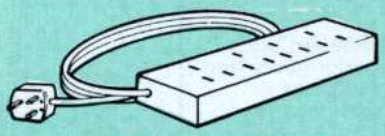

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Continued ——→

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Aries 1200 MODEM

APPROVED for connection to telecommunication systems specified in the instructions for use subject to the conditions set out in them

Up till now buying a modem was a compromise between price and performance, but the new Aries 1200 offers performance and features not found on modems costing two or three times as much. Look at the features offered by the Aries 1200, features which you wouldn't expect from a modem at this price – and some which you would be lucky to find on a modem at any price.

- Operates in V21 (300/300), V23 (1200/75 and 75/1200) and proprietary V23 1200 mode.
- Connect it to any type of computer or terminal via the 25 way serial D connector or the BBC standard 5 pin Domino socket.
- A built in phone socket means your phone plugs straight through.
- A reset switch so the hardware makes it easy to restart – even when your software doesn't.
- Industry standard Hayes (C) compatibility means that this is one of the easiest modems to use. It can automatically work out the speed your computer is working at, and even the speed and protocol of the modem at the other end.
- Auto Call mode can dial using tone or pulse (the modem works that out too), and when it connects it will automatically determine the speed of the answering modem.
- Auto answer mode means the modem can be left unattended to answer calls from other modems, and of course it automatically works out the speed and protocol of the calling modem.
- The built in speaker and front panel LED's mean that you always know what the modem is doing.

. . . Features at any price.

- Proprietary V23 mode mean that two Aries 1200's can communicate at 1200/1200 and in this situation you can take advantage of the built in data compaction which reduces the volume of text you send by 30%.
- Built in scrambler means that data transferred between two Aries modems is automatically encrypted. The encryption code can be user defined for a totally private email system.
- User defined control commands means that the Aries can even be used from a dumb terminal or with non standard software.
- Front panel light include indicators for Power, Auto Answer Mode, Transmit, Receive, On line, Terminal ready and Carrier Detect. There's even an indicator to show the quality of the phone line.
- Internal watch-dog monitors the modems activity and in the event of a power failure or computer crash it automatically resets the modem. The Aries modem can never hold open your phone line or lock up your computer.
- Built in printer port allows the Aries to direct incoming data directly to a printer, text can be tagged so that it is selectively sent either to the printer or the computer.
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Hayes Compatible BBC Comms Software ROM & Manual **£25**

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The WAPPING EDITOR

Watford Electronics bring professional quality Desktop Publishing to the Beeb. The Wapping Editor is a totally self contained mouse-driven desktop publishing package designed to run on the BBC B, B+ and Master computers. The massive 64K Rom contains ALL the software you need to do your own publishing. It 'Brings the Freedom of Press' to your fingertip. The software has a word processor, a graphics package, a page layout section and a font designer. Although very sophisticated, Wapping Editor is simplicity itself to use. Anyone already familiar with Quest Paint will immediately feel at home.

GRAPHICS PACKAGE

Imagine Quest Paint re-written to take advantage of the high resolution of Mode 0, well this is it. The Wapping Editor could well be worth buying for this facility alone. This must surely be the graphics.

WORD PROCESSOR

This section is a fully functional word processor specially tailored to suit the Desktop Publishing environment. Gone are all the unnecessary and cumbersome text formatting commands – these are dealt with in the 'Page-Layout' section. The features of this word processor include wordwrap, wordcount, insert/overwrite, move block, copy block, delete block, search and replace, browse, etc, many of these features being mouse controlled. Text input can of course be taken from existing word processor files like Wordwise, View, etc, but it is not necessary to have a separate word processor in order to use this package.

PAGE-LAYOUT SECTION

Page Layout becomes easy using these mouse-driven routines. The user simply 'pulls' a rectangle onto the page and states which text document or graphic is required to fill the space – it's as simple as that! Text can be automatically printed in a pre-set number of columns, left justified and/or right justified, or centered. Several different typefaces can be held in memory at one time. Graphics may be stretched, squahsed or cropped to fit any size rectangle. Graphics input can be from the software provided in the package or, using the 'mode convert', from any graphics mode screen.

THE FONT EDITOR

This is an enhanced version of the font editor contained in the Con-Quest ROM and allows the editing of ALL 95 characters. As well as being able to design your own typefaces, fonts from other DTP packages or from Quest Pain may be loaded into the editor and converted for use with the Wapping Editor. This sophisticated editor has numerous functions including slide, flip, invert and rotate individual characters or the whole font. Individual characters can be mirrored or copied and a mask feature allows you to superimpose two characters. Lines and columns can be inserted or deleted allowing the character to be stretched or squashed. This font editor will also allow 'font' and 'brush' files to be designed for use with Quest Paint.
This package is the latest in the line of integrated professional quality mouse-driven software from Watford Electronics, the company that adds power to Beeb.

Launch Offer: **£69**

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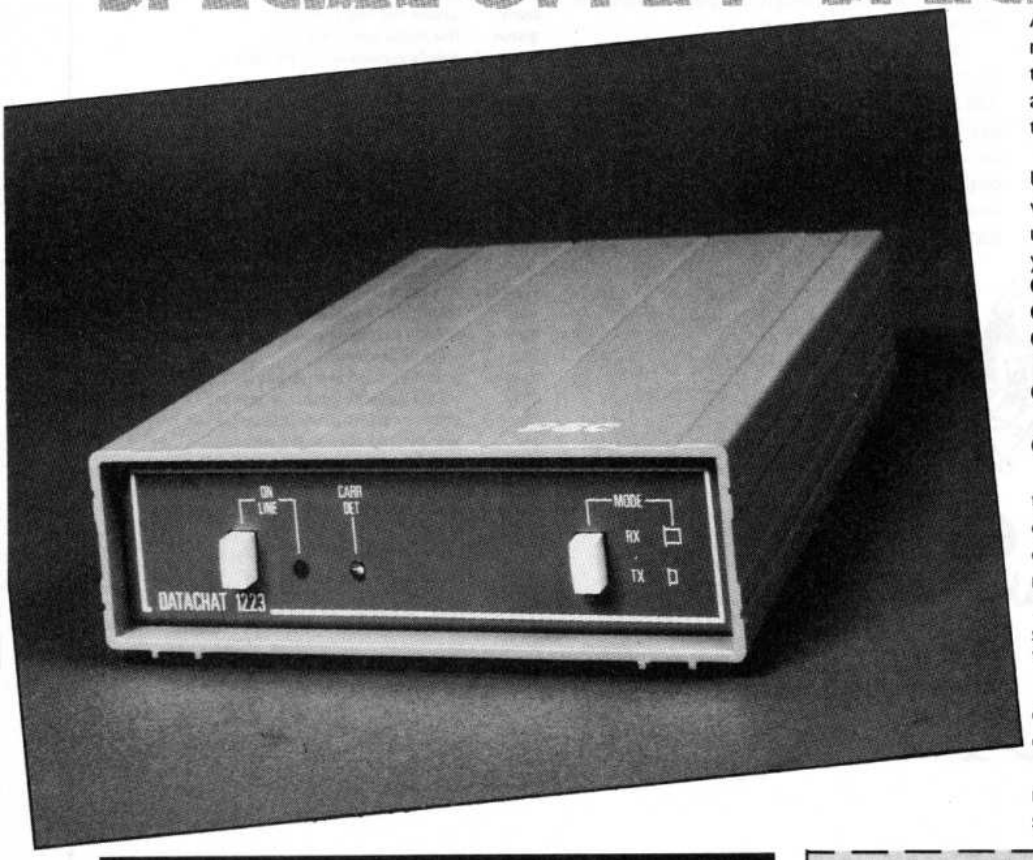

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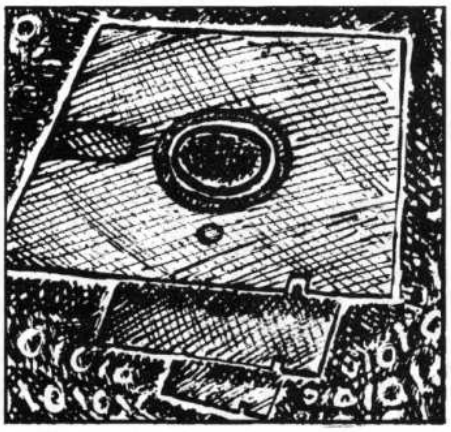
BBC Master Compact requires RS232 interface.

Jonathan Copus

Most computer games are like an England cricket team – only one or two people can actually play. But this one works best as a team effort. For a Christmas party, it's a real cracker



The personal touch

It's much better, though, to personalise the proceedings, in two ways.

First, you can substitute the names of your guests – or even your address – in lines 320 to 340. A maximum of twelve characters per line is allowed. And then the real idea is for you to make up your own clues to suit both your domicile and your guests' special interests. Just follow the format:

DATA Clue, colour number, ANSWER

the case with the examples in the program, because they obviously had to be of a general nature. But your clues could point to a particular book, say, or the picture of Aunt Maude you use to hide that hole in the wallpaper.

Talking of Aunt Maude, even she can take a turn at the keyboard, because PROCinput ensures you can only type the answers in capitals. Pressing BREAK will restore your machine to normal, of course.

By the way, if you don't get the one about the Communist French town, pour yourself a glass of Red Bordeaux. Cheers!

Procedures

Input	**ensures all input is in CAPS**
title	**prints the title page**
instr	**prints the instructions**
guess	**the main guessing loop**
sta	**prints names letter by letter**
gun	**makes firing sound**
jingle	**plays "Jingle Bells"**
rest	**plays silence!**
delay	**provides a pause**
head	**prints the heading**
big	**prints big letters**
space	**waits for SPACE BAR to be pressed**
wrong	**reports wrong answer**
huh	**makes "oh-oh" sound**
right	**congratulates on right answer**
round	**explains sound effects!**
hurra	**organises applause and fanfare**
clap	**makes clapping sound**
fan	**sounds fanfare**
return	**prints reminder to press RETURN**
clue	**prints answer letter by letter**
ohwell	**gives comfort after failure!**
fin	**prints final clue and farewell**
brain	**identifies BRAIN STRANGLER**
search	**identifies SEARCH clue**
holly	**prints sprig of holly**
sprig	**prints line of sprigs**

TREASURE HUNT

Treasure Hunt is a kind of quiz for you to set your party guests, and sends them scurrying off around your home on a tantalising treasure trail. You won't be able to take part, of course, because you'll know the answers, having typed them in – or better still made them up.

You *can* just key in the program and RUN it – provided you place strategically around your abode some apples, dates, Turkish delight, a Christmas cracker and some logs by the fireside. If you can't manage any one of these, simply change the figure in the relevant DATA statement to 130. And don't forget to put a little gift for each guest in the fridge – anything from a bar of chocolate upwards. Mine's a bottle of Scotch. Oh all right, then, a miniature.

(this last one in capitals).

The colour number is 130 for a "BRAIN STRANGLER" (which you can solve by sheer mental might) and 133 for a "SEARCH CLUE" (where you have to go looking for the answer). Each clue can have a maximum of eight lines, with up to thirty-four characters (but no figures) per line. Don't forget that if you want to include a comma in the clue, you have to put that part in double quotes – as in line 3470, for example.

The only thing to remember when inserting your own clues is that the answer to the one in the *last* DATA statement also has to be used in line 230.

It's best if the "SEARCH CLUES" can only be solved by exercising the legs, and not just the grey matter. Unfortunately this isn't

LISTING LISTING

```
   10 REM CHRISTMAS
   20 REM TREASURE
   30 REM HUNT
   40 REM GENERATOR
   50 REM JONATHAN COPUS
   60 REM (C)ASP 1989
   70 MODE 7
   80 *FX200,1
   90 A%=1:try%=0
  100 PROCinput
  110 DIM line$(10)
  120 ENVELOPE 1,1,0,0,0,0,0,0
,126,-1,-8,-2,126,0
  130 ENVELOPE 2,1,0,0,0,0,0,0
,126,-4,-1,-1,126,100
  140 ENVELOPE 3,128,1,0,0,20,
0,0,126,0,0,-126,126,0
```

```
  150 ENVELOPE 4,1,0,0,0,0,0,0
,100,-1,0,-2,126,110
  160 VDU23,1,0;0;0;0;
  170 PROCtitle
  180 ENVELOPE 1,1,0,0,0,0,0,0
,126,-5,-1,-1,126,100
  190 PROCinstr
  200 VDU23,1,1;0;0;0;
  210 REPEAT
  220 PROCguess
  230 UNTIL ANSWER$="CICERO"
  240 PROCfin
  250 END
  260
  270 DEFPROCtitle
  280 PROChead(1,2)
  290 PROCjingle(7)
  300 PROCbig(6,11,133,"SPECIA
LLY DESIGNED FOR")
  310 PROCdelay(30)
  320 PROCsta(14,"READERS OF")
  330 PROCsta(17,"A&B")
  340 PROCsta(20,"COMPUTING")
  350 PROCsprig(22)
  360 PROCdelay(200)
  370 ENDPROC
  380
  390 DEFPROCsta(Y%,B$)
  400 X=15.5-LEN(B$)*3/2
  410 FOR B%=1TOLENB$
  420 A$=MID$(B$,B%,1)
  430 FOR A%=Y%TOY%+1
  440 PRINTTAB(X+B%*3,A%)CHR$1
34CHR$141A$
  450 NEXT
  460 IF A$>" " PROCgun
  470 NEXT
  480 ENDPROC
  490
  500 DEFPROCgun
  510 SOUND 0,1,4,1
  520 PROCdelay(8)
  530 ENDPROC
  540
  550 DEFPROCjingle(U%)
  560 FOR B%=1 TO 2
  570 PROCholly(36-B%*7,U%,35)
  580 FOR N%=1 TO 3
  590 SOUND 1,2,149,7
  600 SOUND 2,2,165,7
  610 SOUND &1001,0,0,1
  620 SOUND &1002,0,0,1
  630 NEXT
  640 SOUND &1001,0,0,8
  650 SOUND &1002,0,0,8
  660 NEXT
  670 PROCholly(15,U%,55)
  680 SOUND 1,2,149,7
  690 SOUND 2,2,165,7
  700 SOUND &1001,0,0,1
  710 SOUND &1002,0,0,1
  720 SOUND 1,2,145,7
  730 SOUND 2,2,177,7
  740 SOUND &1001,0,0,1
  750 SOUND &1002,0,0,1
  760 SOUND 1,2,137,7
  770 SOUND 2,2,149,7
  780 PROCholly(8,U%,45)
  790 SOUND &1001,0,0,1
  800 SOUND &1002,0,0,5
  810 SOUND 1,2,129,7
  820 SOUND 2,2,157,3
  830 SOUND &1001,0,0,1
  840 SOUND &1002,0,0,1
  850 SOUND 1,2,149,12
  860 SOUND 2,2,165,12
  870 PROCholly(1,U%,70)
  880 PROCdelay(50)
  890 ENDPROC
  900
  910 DEFPROCrest(H%,R%)
  920 SOUND H%+&201,0,0,R%
  930 SOUND H%+&202,0,0,R%
  940 SOUND H%+&203,0,0,R%
  950 ENDPROC
  960
  970 DEFPROCdelay(TI)
  980 T=TIME
  990 REPEAT UNTIL TIME>T+TI
 1000 ENDPROC
 1010
 1020 DEFPROChead(V%,Z%)
 1030 PRINTTAB(V%,Z%)CHR$131CH
R$157SPC(33);CHR$156
 1040 FOR N%=Z%+1 TO Z%+2
 1050 PRINTTAB(V%-1,N%)CHR$141
CHR$131CHR$157CHR$129SPC(3)"CH
RISTMAS TREASURE HUNT";SPC(6);
CHR$156
 1060 NEXT
 1070 PRINTTAB(V%,N%)CHR$131CH
R$157SPC(33);CHR$156
 1080 ENDPROC
 1090
 1100 DEFPROCinstr
 1110 CLS
 1120 PROChead(1,2)
 1130 PRINT''" This is a trea
sure hunt with a"'" differenc
e. The clues are of two"'" k
inds:"CHR$130"BRAIN STRANGLERS
"CHR$135"and"'CHR$133" SEARCH"
CHR$135"clues."
 1140 PRINT'" Each clue can b
e solved by"'" entering a"CHR
$131"PASSWORD."CHR$135"The"CHR
$131"PASSWORD"'" is obtained
either directly (from"
 1150 PRINT" the"CHR$130"BRAI
N STRANGLER"CHR$135"itself) or
"'" else as the result of a"C
HR$133"SEARCH."
 1160 PROCdelay(1000)
 1170 PROCbig(0,20,134,"CONFUS
ED?")
 1180 PROCdelay(100)
 1190 PROCspace
 1200 CLS:PROChead(1,2)
 1210 PRINT'" O.K. - let's pu
t it another way."'" Each"CH
R$130"BRAIN STRANGLER"CHR$135"
will give you"'" a direct hin
t at a"CHR$131"PASSWORD"CHR$13
5"to"'" solve it. But to sol
ve a"CHR$133"SEARCH"
 1220 PRINT" clue you have to
 go and look for"'" the answe
r, and THAT will give you"'"
the"CHR$131"PASSWORD.";
 1230 IF A% PROCdelay(1000)
 1240 PRINT"çLet's give it a t
ry."
 1250 IF A% PROCdelay(150)
 1260 PRINT'" Type in the ans
wer to this clue:"'" (you can
 <DELETE> any mistakes)"
 1270 IF A% PROCdelay(250)
 1280 PRINT'TAB(8)CHR$130"Alic
e in"CHR$131"*********"
 1290 *FX15,1
 1300 PROCreturn
 1310 ANSWER$="WONDERLAND"
 1320 VDU23,1,1;0;0;0;
 1330 INPUTTAB(18,19)answer$
 1340 IF answer$=ANSWER$ PROCr
ight: ELSE PROCwrong:A%=0:GOTO
 1200
 1350 CLS:PROChead(1,2)
 1360 VDU23,1,0;0;0;0;
 1370 PRINT'"" A word of comf
ort: if you get the"'CHR$131"
PASSWORD"CHR$135"wrong three t
imes, the"'" computer will st
art to help you."
 1380 PROCdelay(500)
 1390 PRINT''CHR$134" SO..."
 1400 PROCdelay(100)
 1410 PRINT'TAB(4)CHR$134"NOW
YOU KNOW HOW TO PLAY IT..."
 1420 PROCdelay(150)
 1430 PRINT'TAB(7)CHR$134"FIRS
T REAL CLUE COMING UP!!"
 1440 PROCdelay(250)
 1450 PROCbig(11,20,133,"GOOD
LUCK!!!")
 1460 PROCdelay(600)
 1470 ENDPROC
 1480
 1490 DEFPROCbig(X%,Y%,col%,A$
)
 1500 FOR A%=Y%TOY%+1
 1510 PRINTTAB(X%,A%)CHR$(col%
);CHR$(141);A$
 1520 NEXT
 1530 ENDPROC
 1540
 1550 DEFPROCspace
 1560 *FX15,0
 1570 PRINTTAB(7,23)CHR$136CHR
$129"Press the SPACE BAR"
 1580 REPEAT UNTIL GET=32
 1590 ENDPROC
 1600
 1610 DEFPROCwrong
 1620 try%=try%+1
 1630 CLS
 1640 VDU23,1,0;0;0;0;
 1650 PROChuh
 1660 PRINT
 1670 FOR J%=1 TO 210
 1680 PRINTCHR$(J%MOD7+129)"NO
!";
 1690 NEXT
 1700 PRINT
 1710 IF try%-2<LEN(ANSWER$) P
RINTCHR$(136);CHR$(130);" YO
U GOT IT WRONG - TRY AGAIN!"
 1720 PROChead(2,10)
 1730 PROCdelay(250)
 1740 VDU23,1,1;0;0;0;
 1750 ENDPROC
 1760
 1770 DEFPROChuh
 1780 SOUND 1,3,5,5
 1790 SOUND 1,0,0,4
 1800 SOUND 1,-15,0,10
 1810 ENDPROC
 1820
 1830 DEFPROCright
 1840 CLS
 1850 VDU23,1,0;0;0;0;
 1860 try%=0
 1870 FOR J%=1 TO 12
 1880 PRINTCHR$(J%MOD7+129)"YE
S! CONGRATULATIONS! YOU GOT IT
 RIGHT!"
 1890 NEXT
 1900 PROChead(2,10)
 1910 IF answer$="WONDERLAND"
PROCround
 1920 PROChurra
 1930 PROCdelay(300)
 1940 VDU23,1,1;0;0;0;
 1950 ENDPROC
 1960
 1970 DEFPROCround
 1980 PROCbig(0,21,131,"HAVE A
 ROUND OF APPLAUSE AND A FANFA
RE")
 1990 ENDPROC
 2000
 2010 DEFPROChurra
 2020 FOR N%=1 TO 8
```

```
 2030 PROCclap
 2040 NEXT
 2050 PROCfan
 2060 ENDPROC
 2070
 2080 DEFPROCclap
 2090 SOUND 0,1,7,4
 2100 SOUND 1,0,RND(32)*4+124,
4
 2110 ENDPROC
 2120
 2130 DEFPROCfan
 2140 SOUND &201,4,81,12
 2150 SOUND &202,4,97,12
 2160 SOUND &203,4,109,12
 2170 PROCrest(0,1)
 2180 SOUND &201,4,81,3
 2190 SOUND &202,4,97,3
 2200 SOUND &203,4,109,3
 2210 PROCrest(0,1)
 2220 SOUND &201,4,81,6
 2230 SOUND &202,4,97,6
 2240 SOUND &203,4,109,6
 2250 PROCrest(&1000,4)
 2260 SOUND &201,4,73,6
 2270 SOUND &202,4,89,6
 2280 SOUND &203,4,101,6
 2290 PROCrest(&1000,4)
 2300 SOUND &201,4,81,32
 2310 SOUND &202,4,97,32
 2320 SOUND &203,4,109,32
 2330 ENDPROC
 2340
 2350 DEFPROCguess
 2360 line%=0
 2370 REPEAT
 2380 READ line$(line%)
 2390 line%=line%+1
 2400 UNTIL ASC(line$(line%-1)
)<59
 2410 READ ANSWER$
 2420 col%=VAL(line$(line%-1))
 2430 CLS:PROChead(1,2)
 2440 FOR J%=0 TO line%-2
 2450 PRINTTAB(1,J%+8)CHR$(col
%);line$(J%)
 2460 NEXT
 2470 PRINT'TAB(1)CHR$131STRIN
G$(LEN(ANSWER$),"*")
 2480 FOR R%=1 TO LEN(ANSWER$)
 2490 IF MID$(ANSWER$,R%,1)="
" PRINTTAB(R%+1,line%+8)" "
 2500 NEXT
 2510 IF col%=130 AND try%-2<L
EN(ANSWER$) PROCbrain
 2520 IF col%=133 AND try%-2<L
EN(ANSWER$) PROCsearch
 2530 *FX15,1
 2540 answer$="":clue$=""
 2550 IF try%>2 PROCclue(try%-
2)
 2560 IF try%-2=LEN(ANSWER$) V
DU23,1,0;0;0;0;:PROCdelay(300)
:PROCohwell:ENDPROC
 2570 PROCreturn
 2580 z%=LEN(clue$)+2
 2590 INPUTTAB(z%,line%+8)answ
er$
 2600 answer$=clue$+answer$
 2610 IF answer$=ANSWER$ PROCr
ight ELSE PROCwrong:GOTO 2430
 2620 ENDPROC
 2630
 2640 DEFPROCreturn
 2650 PRINTTAB(3,22)CHR$(136);
CHR$(129);"Press <RETURN> when
 you have"TAB(7,23)CHR$(136);C
HR$(129);"typed in the answer"
 2660 ENDPROC
 2670
 2680 DEFPROCclue(M%)
 2690 FOR J%=1 TO M%
 2700 clue$=MID$(ANSWER$,1,J%)
 2710 PRINTTAB(2,line%+8)clue$
 2720 NEXT
 2730 ENDPROC
 2740
 2750 DEFPROCohwell
 2760 CLS:PROChead(1,2)
 2770 PRINTTAB(4,10)CHR$131"Co
o, you didn't half make a"'CHR
$131"    mess of that!"''CHR$1
31"    Never mind - let's go o
n."
 2780 PROCdelay(350)
 2790 VDU23,1,1;0;0;0;:try%=0
 2800 ENDPROC
 2810
 2820 DEFPROCfin
 2830 *FX15,1
 2840 VDU23,1,0;0;0;0;
 2850 CLS:PROChead(1,2)
 2860 PRINT''CHR$129" And now
. . ."
 2870 PROCdelay(200)
 2880 PRINT'CHR$134" So near,
and yet so very far!"''CHR$134
" Let Reason be your guiding s
tar."''CHR$134" If the"CHR$131
"TREASURE"CHR$134"you would fi
nd"''CHR$134" You must now app
ly your mind,"
 2890 PRINT'CHR$134" Beat your
 grey cells black and blue,"''
CHR$134" Trying to solve this
final clue:-"
 2900 PROCdelay(800)
 2910 PROCspace
 2920 CLS:PROChead(1,2)
 2930 PRINTTAB(15,12)CHR$133"B
rrrr!"
 2940 PROCdelay(200)
 2950 PROCbig(11,15,131,"GOOD
 LUCK!")
 2960 PROCdelay(100)
 2970 PROCbig(5,18,131,"- AND
MERRY CHRISTMAS!")
 2980 PROCjingle(21)
 2990 PROCsprig(7)
 3000 VDU21
 3010 ENDPROC
 3020
 3030 DEFPROCbrain
 3040 PRINTTAB(1,19)CHR$134"It
's a"CHR$130"BRAIN STRANGLER!"
 3050 ENDPROC
 3060
 3070 DEFPROCsearch
 3080 PRINTTAB(1,19)CHR$134"It
's a"CHR$133"SEARCH"CHR$134"cl
ue!"
 3090 ENDPROC
 3100
 3110 DEFPROCinput
 3120 *FX15,0
 3130 ret=!&228
 3140 P%=&70
 3150 [OPT 0
 3160 .caps
 3170 PHP:PHA:TXA:PHA:TYA:PHA
 3180 LDX #32
 3190 LDA #202
 3200 JSR &FFF4
 3210 PLA:TAY:PLA:TAX:PLA:PLP
 3220 JMP ret
 3230 ]
 3240 ?&228=caps
 3250 ?&229=caps DIV 256
 3260 ENDPROC
 3270
 3280 DEFPROCholly(S%,T%,V%)
 3290 PROCdelay(V%)
 3300 FOR R%=1 TO S%
 3310 *FX19
 3320 PRINTTAB(R%,T%);
 3330 VDU146,232,252,176,160,2
48,252,10,8,8,8,8,8,8,8,146,16
2,239,255,250,255,167,10,8,8,8
,8,8,8,8,145,162,146,184,161,1
45,166
 3340 NEXT
 3350 ENDPROC
 3360
 3370 DEFPROCsprig(Y%)
 3380 FOR S%=29 TO 1 STEP -7
 3390 PROCholly(S%,Y%,0)
 3400 NEXT
 3410 ENDPROC
 3420
 3430 DATA Just the girl to si
ng at Christmas.,130,CAROL
 3440 DATA Possibly a blind or
 timely fruit.,133,DATE
 3450 DATA Got up a white one,
for Athens and York.,130,ROSE
 3460 DATA Can you fire this c
leric?,130,CANON
 3470 DATA This chap spends Ch
ristmas,"in Paris, perhaps.",1
30,NOEL
 3480 DATA The love of it is t
he root,of all evil.,130, MONE
Y
 3490 DATA In addition they mu
ltiply,by the fireside.,133,LO
GS
 3500 DATA Christmas fare to g
obble.,130,TURKEY
 3510 DATA A rotund song?,130,
ROUND
 3520 DATA "We're often paired
, me old fruit,",to produce a
Cockney namesake,to climb.,133
,APPLES
 3530 DATA The good king's fea
st.,130,STEPHEN
 3540 DATA The virtue of Gilbe
rt and Sullivan.,130,PATIENCE
 3550 DATA Where they ride cha
riots of fire.,130,JERUSALEM
 3560 DATA Lethal potential? S
ounds like it.,130,KILOVOLT
 3570 DATA A little chunk of E
astern promise?,133,TURKISH DE
LIGHT
 3580 DATA A leading light at
Christmas.,130,STAR
 3590 DATA A seasonal composer
.,130,VIVALDI
 3600 DATA Beans good for the
heart?,130,PULSES
 3610 DATA A codpiece for five
 musicians?,130,TROUT QUINTET
 3620 DATA Are lions to help u
s fly?,130,AILERONS
 3630 DATA BANG! Now there's a
 novelty!,133,CHRISTMAS CRACKE
R
 3640 DATA Is it a bird?  Is i
t a devil?,"No, it's a compute
r telephone",operator.,130,MOD
EM
 3650 DATA "In a word, this co
mmunist French",town is drunk!
,130,CLARET
 3660 DATA An artist who playe
d it by ear.,130,VAN GOGH
 3670 DATA Some French maps fo
r a philosopher.,130,DESCARTES
 3680 DATA This Roman might fo
rm a small firm,growing a stap
le Oriental crop!,130,CICERO
>
```

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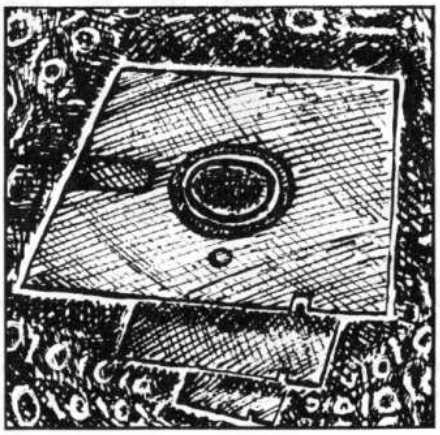
Extended graphics generator

Terry Blunt

Compatible with:
- **Master 128**
- **Master Compact**
- **Model B/B+ with GXR graphics ROM**

As well as being a powerful drawing utility, this graphics generator is especially useful for those programmers who want to incorporate their pictures into BASIC programs.



PROGRAMMING PLUS

The program is menu driven with error trapping. Whilst in the menu mode OS (*) commands can be entered in the normal way. A return to the menu can be made at any time by pressing <ESCAPE>.

The generator stores all information in the form of lines of VDU codes, regardless of whether they were entered from a file, via the keyboard or drawn.

The menu options are:

1 Clear entries
2 Save file
3 Load file
4 Keyboard entry
5 Draw screen
6 Print screen data
7 Editor keys
8 Quit

(1) This option clears out any previously generated screen ready for a fresh start. It is automatically performed when the program is first run or when a screen is loaded from file.

(2) This option will only be available once a screen has been drawn with at least two lines. You are asked if a spooled file is to be saved. Spooled files cannot be re-loaded into the generator but can be EXECed at any time. A non-spooled file can be re-loaded, but not so easily used outside the generator.

(3) Loads a previously saved file. The file has an identifier string which ensures that an invalid file can't be inadvertently loaded. (Note that a deliberate error is created.)

(4) This has its own sub-menu and allows any VDU code chain of up to 34 bytes to be entered as one line. Lines can be inserted, deleted, exchanged or entered from scratch. The numbers are a continuous string of two-digit hexadecimal values.

eg 170C0700000707000007

This line would change ECF pattern number 1 to a fine black and white grating effect.

Line 0 *must* begin with the Mode definition and VDU 5. It is best not to put anything else on this line apart from VDU 19 definitions. If the final screen is wanted to be used in a program that uses the non-shadow Modes 0,1 and 2 it should be built up in the normal way and the Mode number changed here before it is finally spooled. Modes 4 and 5 can also be set. (There is little point in having them as shadow Modes.)

All trailing 0s for VDU codes must be entered.

eg VDU 19,2,5,0,0,0

becomes

130205000000

When entering VDU codes directly, remember that all two byte values go in low byte first.

Inserting a line creates an empty line at the current line number, after moving this and all later lines up to make space. If you save the screen with empty lines they will be ignored and only valid lines will actually be saved.

Deleting a line causes all later lines to be shunted down to fill the space.

Exchanging the current line with another will not affect any other lines, although if either of the swapped lines contain colour commands etc the results could be bizarre.

(5) The drawing routine checks to see if a screen already exists, and if not offers Modes 0 1 and 2. In fact the shadow RAM equivalents are used. If there is a valid screen it will be displayed up to the last line (or line set with <M>). Due to the calculations that are being made as it is drawn this is slower than the VDU drivers are actually capable of performing.

The arrow is the starting character and the cursor postition indicated is just above the tip.

The number of the previously drawn line is continuously displayed in the bottom left-hand corner. This will be 0 (the Mode definition) when you first start.

Keys

Movement around the screen is with the cursor keys. If the <SHIFT> key is pressed at the same time much faster movement is possible. Keys <1>, <2>, <3> and <4>

select whether the cursor keys move the whole shape around the screen or change its dimensions.

For all shapes <1> selects shape movement.

For most shapes <2> gives the second point, and where relevant <3> the third point, <4> the forth. All relative to the start.

For circles, arcs, sectors and segments the radius is set by the vertical cursors on <2>.

For arcs, sectors and segments the horizontal cursors on <2> set the circular length and on <3> the angle.

For ellipses <2> sets the two radii and the horizontal cursors on <3> the angle.

The current shape is set using:

<L> line
<T> triangle
<P> parallelogram
<R> rhombus/arc
<S> sector/segment
<C> circle
<E> ellipse

<O> is used to toggle between outline or filled shapes, or from one shape to the other in the cases <R> and <S>.

Other keys are:

<@> enables text character entry. The text is first displayed at the top of the screen. When <RETURN> is pressed the text line comes under normal cursor movement control.

<H> increments the current foreground colour and embeds this in the next line that is fixed. If <SHIFT> is pressed the colour is decremented.

<X> sets the current ECF pattern. This is also embedded in the next line.

<COPY> fixes the current shape as a line in the screen stack.

<COPY> with <F> performs and fixes a flood fill. <O> determines whether the fill is to the current hue or until not the colour at the cursor. You can't flood fill until not an ECF background, although with care this can

be done from the keyboard.

<M> permits display only to a given line. The line selected is *NOT* displayed and becomes the current line for overwriting. After making changes the line number can be reset to the last line so that the whole effect can be reviewed.

<B> provides the ability to skip over a group of lines in the drawing process. This is particularly useful where a fiddly bit of detail is being worked on at the end of a large screen stack and you don't want to keep waiting for the screen to re-draw.

<D> deletes the current (not last drawn) line. If you are already at the top of the stack nothing will happen otherwise all later lines will be shunted down to fill the space.

<I> displays all the above notes in brief, identifying the current hue, ECF pattern, line number, etc.

(6) If there is a valid screen, lines are sent to the printer numbered and displayed in exactly the form required by option 4. This enables a hard copy to be made in a form that can be easily, albeit a little tediously, re-entered.

(7) This is exactly the same as <I> in option 5.

(8) Obvious! It gives you a chance to change your mind though.

As mentioned earlier the spooled file can be used from the keyboard simply with *EXEC (filename), although you may find that there are 'spare' characters hanging in the keyboard buffer afterwards. A better alternative is to use the program segment below:

```
1000 F%=OPENIN "picture"
1010 FOR I%=1 TO EXT #F%
1020 N%=BGET #F%:VDU N%
1030 NEXT 1040 CLOSE #F%
```

If a quick screen draw is wanted without jerks, and memory permits, use something like the following:

```
1000 F%=OPENIN "picture"
1010 E%=EXT #F%-1
1020 CLOSE #F%
1030 HIMEM=HIMEM-E%
1040 OSCLI ("LOAD picture
     "+STR$~HIMEM)
1050 FOR I%=0 TO E%
1060 VDU I%?HIMEM
1070 NEXT
```

All the above methods will draw the screen surprisingly fast, correctly setting the screen Mode first. File lengths are quite independent of the screen Mode, being governed only by the VDU commands themselves.

It is possible to use the character strings produced by the generator in the form displayed by option 4 or printed by option 6 for permanent use, in say, header programs. To do this use the routine below:

```
1000 FOR I%=0 TO (number of lines)
1010 READ a$
1020 REPEAT
1030 VDU EVAL("&"+LEFT$(a$,2))
1040 a$=MID$(a$,3)
1050 UNTIL a$="" 1060 NEXT
32000 DATA 168105 etc.
32010 DATA ?????? etc.
```

This may not take any less memory space than the usual MOVE/DRAW combinations. It will depend on the complexity of the drawing. It will however, be much easier to set up.

LISTING LISTING

```
   10 REM  Picture Generator
   20 REM  by  Terry Blunt
   30 REM  (C)ASP 1989
   40 :
   50 PROCinit
   60 ON ERROR PROCerror
   70 :
  100 REPEAT
  110 RESTORE 32000
  120 MODE 135:*FX 4
  130 PRINT TAB(10,5)CHR$134"P
ICTURE GENERATOR"''
  140 FOR I%=1 TO 8
  150 READn$
  160 PRINT SPC4 CHR$129;I% CH
R$130 SPC5n$
  170 NEXT
  180 PRINT''SPC10 CHR$131"ENT
ER NUMBER";
  190 G%=GET-48
  200 PRINT''CHR$134 G% SPC5;
  210 PROCwait
  220 ONG% GOSUB 1000,2000,300
0,4000,5000,6000,7000,8000 ELS
E IF G%=-6 PROCoscli
  230 UNTIL FALSE
  240 :
  900 DEF PROCram
  910 *FX108,1
  920 IF A% OSCLI"SRWRITE 3000
 8000 0":A%=FALSE ELSE VDU22,0
%,5:*SRREAD 3000 8000 0
  930 *FX108
  940 ENDPROC
  950 :
 1000 FOR T%=0 TO M%
 1010 S%!(T%*L%)=0
 1020 NEXT
 1030 T%=1
 1040 RETURN
 1050 :
 2000 N%=0:IF S%?L%=0 RETURN E
LSE VDU11
 2010 f$=FNinput("save")
 2020 F%=OPENOUT f$
 2030 IF FNyn("Save SPOOLed fi
le") a%=1 ELSEa%=0:PRINT#F%,"p
icture"
 2040 REPEAT
 2050 FOR I%=a% TO S%?(N%*L%)
 2060 BPUT#F%,S%?(N%*L%+I%)
 2070 NEXT
 2080 N%=N%+1
 2090 IF S%?(N%*L%)=1 REPEAT:N
%=N%+1:UNTILS%?(N%*L%)<>1
 2100 UNTIL S%?(N%*L%)=0
 2110 CLOSE#F%
 2120 RETURN
 2130 :
 3000 GOSUB 1000:T%=0:f$=FNinp
ut("load")
 3010 F%=OPENIN f$
 3020 IF F%=0 PROCkey("Picture
 not saved"):RETURN
 3030 INPUT#F%,a$:IFa$<>"pictu
re" a$=FALSE
 3040 REPEAT
 3050 S%?(T%*L%)=BGET#F%
 3060 FOR I%=1 TO S%?(T%*L%)
 3070 S%?(T%*L%+I%)=BGET#F%
 3080 NEXT
 3090 T%=T%+1
 3100 UNTIL EOF#F%
 3110 CLOSE#F%
 3120 RETURN
 3130 :
 4000 N%=0
 4010 REPEAT
 4020 CLS:PRINT''CHR$134"A"CHR
$130"Line number  (0 _ "STR$M%
")  "CHR$135;N%''CHR$134"B"CHR
$130"Insert line"
 4030 PRINT'CHR$134"C"CHR$130"
Delete line"''CHR$134"D"CHR$13
0"Exchange line"''CHR$134"E"CH
R$130"Data:"'':PROClist
 4040 PRINT'CHR$131"ESCAPE"CHR
$130"EXIT"CHR$134"  Select A_E
";
 4050 G%=GET AND 95-64
 4060 PRINT CHR$13 CHR$133 CHR
$(G%+64)" Selected"SPC16
 4070 ONG% GOSUB 4100,4200,430
0,4400,4500 ELSE
 4080 UNTIL FALSE
 4090 :
 4100 PROCmove(0):RETURN
 4110 :
 4200 IF T%=M% PROCkey("Stack
full"):RETURN
 4210 IF N% PROCwait ELSE RETU
RN
 4220 FOR I%=M%*L% TO N%*L% ST
EP-4
 4240 S%!I%=S%!(I%-L%)
 4250 NEXT
 4260 S%!(N%*L%)=1:T%=T%+1
 4270 RETURN
 4280 :
 4300 PROCdelete:RETURN
 4310 :
 4400 IF N%=0 OR T%<3 RETURN
 4410 PROCnum(1,T%-1)
 4420 IF I%=N% ORn$="" RETURN
 4430 FOR J%=0 TO L%-1
 4440 a%=S%?(N%*L%+J%):S%?(N%*
L%+J%)=S%?(I%*L%+J%):S%?(I%*L%
+J%)=a%
 4450 NEXT
 4460 RETURN
 4470 :
 4500 IF N%>M% PROCkey("Stack
full"):RETURN
 4510 PRINT CHR$134"Enter data
:":INPUT LINE""t$
 4520 IFt$="" RETURN ELSE IF L
ENt$>L%*2 PROCkey("Line too lo
ng"):RETURN
 4530 I%=0
 4540 REPEAT:I%=I%+1
 4550 S%?(N%*L%+I%)=EVAL("&"+L
EFT$(t$,2)):t$=MID$(t$,3)
 4560 UNTILt$=""
 4570 S%?(N%*L%)=I%:T%=T%+1
 4580 RETURN
 4590 :
 5000 !x%=640:!y%=512:Q%=301:*
FX 4 1
 5010 PROCstart:e%=E%:c%=C%
 5020 REPEAT
 5030 P%=0:n%=0:t$=CHR$224
 5040 x%!4=-16:x%!8=16:x%!12=0
:y%!4=16:y%!8=0:y%!12=-16
 5050 PROCfill
 5060 REPEAT:*FX15
 5070 K%=GET AND 95
 5080 v%=(INKEY-26)-(INKEY-122
)
 5090 w%=(INKEY-42)-(INKEY-58)
 5100 PROCfill
 5110 IF K%<21:IF K%>16 n%=(K%
-17)*4
 5120 IF K%=79 P%=P%EOR1
 5130 IF K%=82 P%=14
 5140 IF K%=83 P%=12
 5150 IF K%=69 P%=10
 5160 IF K%=80 P%=8
 5170 IF K%=84 P%=6
 5180 IF K%=67 P%=4
 5190 IF K%=76 P%=2
```

```
 5200 IF K%=64 PROCline
 5210 IF K%=72 C%=(C%+1)MOD 16
:IF INKEY TRUE C%=(C%+14)MOD 1
6
 5220 IF K%=88 E%=(E%+16)MOD 8
0
 5230 x%!n%=x%!n%+v%*4:y%!n%=y
%!n%+w%*4
 5240 IF INKEY TRUE:x%!n%=x%!n
%+v%*28:y%!n%=y%!n%+w%*28
 5250 IF K%=73 A%=TRUE:PROCram
:PROCinform:PROCkey(""):PROCra
m
 5260 IF K%=77 PROCmove(1):c%=
C%:e%=E%
 5270 IF K%=66 PROCbypass:PROC
start:c%=C%:e%=E%
 5280 IF K%=68 A%=TRUE:PROCram
:VDU22,135,10,10:PROCdelete:PR
OCram
 5290 GCOL E%+3,C%:PROCfill
 5300 UNTIL INKEY-106 AND(P%>1
 ORt$<>CHR$224 OR K%=70)
 5310 GCOLe%+3,c%:MOVE 0,32:PR
INT;N%-1
 5320 VDU7
 5330 IF C%=c% AND E%=e% S%?(N
%*L%)=0:s%=0 ELSE S%!(N%*L%)=&
1203:s%=3:S%?(N%*L%+2)=E%:S%?(
N%*L%+3)=C%:c%=C%:e%=E%
 5340 S%!(N%*L%+1+s%)=&419:S%!
(N%*L%+3+s%)=!x%:S%!(N%*L%+5+s
%)=!y%
 5350 IF K%=70 PROCflood ELSE
PROCsend
 5360 N%=N%+1:T%=N%
 5370 PROCmark
 5380 REPEAT UNTIL NOT INKEY-1
06
 5390 UNTIL FALSE
 5400 RETURN
 5410 :
 6000 IF S%?L%=0 RETURN
 6010 VDU2:PRINT"Picture data"
:N%=0
 6020 REPEAT
 6030 PRINTN% "  ";:PROClist
 6040 N%=N%+1
 6050 UNTIL S%?(N%*L%)=0
 6060 VDU12,3
 6070 RETURN
 6080 :
 7000 PROCinform:PROCkey(""):R
ETURN
 7010 :
 8000 PRINT CHR$13 SPC30 CHR$1
1;
 8010 IF NOT FNyn("Leave Progr
am") RETURN
 8020 CLS:PRINT''"Bye"
 8030 END
 8040 :
10000 PRINTt$:RETURN
10010 :
10020 PLOT17,x%!4,y%!4:RETURN
10030 :
10040 PLOT1,x%!4,y%!4:RETURN
10050 :
10060 PLOT145,0,y%!4:RETURN
10070 :
10080 PLOT153,0,y%!4:RETURN
10090 :
10100 PLOT1,x%!4,y%!4:PLOT1,x%
!8,y%!8:DRAW !x%,!y%:RETURN
10110 :
10120 PLOT0,x%!4,y%!4:PLOT81,x
%!8,y%!8:RETURN
10130 :
10140 PLOT1,x%!4,y%!4:PLOT1,x%
!8,y%!8:PLOT1,-x%!4,-y%!4:DRAW
 !x%,!y%:RETURN
10150 :
10160 PLOT0,x%!4,y%!4:PLOT113,
x%!8,y%!8:RETURN
10170 :
10180 PROCeli:MOVEa,y%!4:PLOT1
97,b,c:RETURN
10190 :
10200 PROCeli:MOVEa,y%!4:PLOT2
05,b,c:RETURN
10210 :
10220 PROCarc:MOVEa,b:PLOT181,
c,d:RETURN
10230 :
10240 PROCarc:MOVEa,b:PLOT173,
c,d:RETURN
10250 :
10260 PLOT1,x%!4,y%!4:PLOT1,x%
!8,y%!8:PLOT1,x%!12,y%!12:DRAW
 !x%,!y%:RETURN
10270 :
10280 PROCarc:MOVEa,b:PLOT165,
c,d:RETURN
10290 :
15000 I%=6
15002 REPEAT:I%=I%+1
15004 S%?(N%*L%+I%+s%)=ASCt$:t
$=MID$(t$,2)
15006 UNTILt$=""
15008 S%?(N%*L%)=s%+I%:RETURN
15010 :
15020 S%?(N%*L%)=s%+12:S%!(N%*
L%+7+s%)=&1119:S%!(N%*L%+9+s%)
=x%!4:S%!(N%*L%+11+s%)=y%!4:RE
TURN
15030 :
15040 S%?(N%*L%)=s%+12:S%!(N%*
L%+7+s%)=&119:S%!(N%*L%+9+s%)=
x%!4:S%!(N%*L%+11+s%)=y%!4:RET
URN
15050 :
15060 S%?(N%*L%)=s%+12:S%!(N%*
L%+7+s%)=&9119:S%!(N%*L%+11+s%
)=y%!4:RETURN
15070 :
15080 S%?(N%*L%)=s%+12:S%!(N%*
L%+7+s%)=&9919:S%!(N%*L%+11+s%
)=y%!4:RETURN
15090 :
15100 S%?(N%*L%)=s%+24:S%!(N%*
L%+7+s%)=&119:S%!(N%*L%+9+s%)=
x%!4:S%!(N%*L%+11+s%)=y%!4
15102 S%!(N%*L%+13+s%)=&119:S%
!(N%*L%+15+s%)=x%!8:S%!(N%*L%+
17+s%)=y%!8
15104 S%!(N%*L%+19+s%)=&519:S%
!(N%*L%+21+s%)=!x%:S%!(N%*L%+2
3+s%)=!y%:RETURN
15110 :
15120 S%?(N%*L%)=s%+18:S%!(N%*
L%+7+s%)=25:S%!(N%*L%+9+s%)=x%
!4:S%!(N%*L%+11+s%)=y%!4
15122 S%!(N%*L%+13+s%)=&5119:S
%!(N%*L%+15+s%)=x%!8:S%!(N%*L%
+17+s%)=y%!8:RETURN
15130 :
15140 S%?(N%*L%)=s%+30:S%!(N%*
L%+7+s%)=&119:S%!(N%*L%+9+s%)=
x%!4:S%!(N%*L%+11+s%)=y%!4
15142 S%!(N%*L%+13+s%)=&119:S%
!(N%*L%+15+s%)=x%!8:S%!(N%*L%+
17+s%)=y%!8
15144 S%!(N%*L%+19+s%)=&119:S%
!(N%*L%+21+s%)=-x%!4:S%!(N%*L%
+23+s%)=-y%!4
15146 S%!(N%*L%+25+s%)=&519:S%
!(N%*L%+27+s%)=!x%:S%!(N%*L%+2
9+s%)=!y%:RETURN
15150 :
15160 S%?(N%*L%)=s%+18:S%!(N%*
L%+7+s%)=25:S%!(N%*L%+9+s%)=x%
!4:S%!(N%*L%+11+s%)=y%!4
15162 S%!(N%*L%+13+s%)=&7119:S
%!(N%*L%+15+s%)=x%!8:S%!(N%*L%
+17+s%)=y%!8:RETURN
15170 :
15180 PROCs_eli(197):RETURN
15190 :
15200 PROCs_eli(205):RETURN
15210 :
15220 PROCs_arc(181):RETURN
15230 :
15240 PROCs_arc(173):RETURN
15250 :
15260 S%?(N%*L%)=s%+30:S%!(N%*
L%+7+s%)=&119:S%!(N%*L%+9+s%)=
x%!4:S%!(N%*L%+11+s%)=y%!4
15262 S%!(N%*L%+13+s%)=&119:S%
!(N%*L%+15+s%)=x%!8:S%!(N%*L%+
17+s%)=y%!8
15264 S%!(N%*L%+19+s%)=&119:S%
!(N%*L%+21+s%)=x%!12:S%!(N%*L%
+23+s%)=y%!12
15266 S%!(N%*L%+25+s%)=&519:S%
!(N%*L%+27+s%)=!x%:S%!(N%*L%+2
9+s%)=!y%:RETURN
15270 :
15280 PROCs_arc(165):RETURN
15290 :
20000 DEF PROCfill
20010 MOVE !x%,!y%
20020 ONP%+1 GOSUB 10000,10000
,10020,10040,10060,10080,10100
,10120,10140,10160,10180,10200
,10220,10240,10260,10280
20030 ENDPROC
20040 :
20500 DEF PROCsend
20510 GCOL E%+0,C%:PROCfill
20520 ONP%+1 GOSUB 15000,15000
,15020,15040,15060,15080,15100
,15120,15140,15160,15180,15200
,15220,15240,15260,15280
20530 ENDPROC
20540 :
21000 DEF PROCflood
21010 GCOL E%+3,C%:PROCfill:GC
OL E%+0,C%:MOVE !x%,!y%:a%=POI
NT(!x%,!y%)+128:VDU18,0,a%:PLO
T137-P% MOD 2*8,0,0
21020 S%?(N%*L%)=s%+15:S%?(N%*
L%+7+s%)=18:S%?(N%*L%+8+s%)=0:
S%?(N%*L%+9+s%)=a%:S%?(N%*L%+1
0+s%)=25:S%?(N%*L%+11+s%)=137-
P% MOD 2*8:S%!(N%*L%+12+s%)=0
21030 ENDPROC
21040 :
21500 DEF PROCarc
21510 a=!x%+SIN(x%!8/100)*y%!4
:b=!y%+COS(x%!8/100)*y%!4:c=!x
%+SIN((x%!8+x%!4)/100)*y%!4:d=
!y%+COS((x%!8+x%!4)/100)*y%!4
21520 ENDPROC
21530 :
21600 DEF PROCs_arc(a%)
21610 S%?(N%*L%)=s%+18:S%!(N%*
L%+7+s%)=&419:S%!(N%*L%+9+s%)=
a:S%!(N%*L%+11+s%)=b
21620 S%?(N%*L%+13+s%)=25:S%?(
N%*L%+14+s%)=a%:S%!(N%*L%+15+s
%)=c:S%!(N%*L%+17+s%)=d
21630 ENDPROC
21640 :
22000 DEF PROCeli
22010 a=SIN(RAD(x%!8)):b=COS(R
AD(x%!8))
22020 c=SQR((y%!4*a)^2+(x%!4*b
)^2)+1
22030 b=!x%+(x%!4^2-y%!4^2)*a*
b/c
22040 a=!x%+x%!4*y%!4/c:c=!y%+
c
22050 ENDPROC
22060 :
22100 DEF PROCs_eli(a%)
22110 S%?(N%*L%)=s%+18:S%!(N%*
L%+7+s%)=&419:S%!(N%*L%+9+s%)=
a:S%!(N%*L%+11+s%)=y%!4
22120 S%?(N%*L%+13+s%)=25:S%?(
```

```
N%*L%+14+s%)=a%:S%!(N%*L%+15+s
%)=b:S%!(N%*L%+17+s%)=c
22130 ENDPROC
22140 :
22500 DEF PROCdelete
22510 IF S%?(N%*L%)=0 ENDPROC
22520 IF N% PROCwait ELSE ENDP
ROC
22530 FOR I%=N%*L% TO M%*L% ST
EP4
22550 S%!I%=S%!(I%+L%)
22560 NEXT
22570 T%=T%-1
22580 ENDPROC
22590 :
23000 DEF PROCmove(a%)
23010 IF a% A%=TRUE:PROCmark:P
ROCram:VDU22,135:PRINT''CHR$13
4"Current line = ";N%'CHR$134"
Move to new line"
23020 PROCnum(a%,M%):IF I%=0 N
%=0:ENDPROC
23030 IF n$>"" REPEAT:I%=I%-1:
UNTIL S%?(I%*L%)>0:N%=I%+1
23040 IF a%=0 ENDPROC
23050 P%=0:t$=CHR$224
23060 a%=Q%:b%=R%:IF N%>=T% PR
OCram:Q%=0:R%=T%-1
23070 T%=N%:PROCstart:Q%=a%:R%
=b%
23080 ENDPROC
23090 :
23500 DEF PROClist
23510 FOR I%=1 TO S%?(N%*L%)
23520 t$=STR$~S%?(N%*L%+I%):IF
 LENt$<2 t$="0"+t$
23530 PRINT t$;
23540 NEXT
23550 PRINT
23560 ENDPROC
23570 :
24000 DEF PROCoscli
24010 PRINT CHR$13 SPC40
24020 REPEAT
24030 INPUT"*"a$:OSCLIa$:PROCk
ey("")
24040 UNTILa%<>42
24050 ENDPROC
24060 :
24500 DEF FNinput(a$)
24510 a%=VPOS
24520 REPEAT
24530 PRINT TAB(0,a%) SPC120 T
AB(0,a%)CHR$134"Filename to "a
$'CHR$133;
24540 INPUT""b$
24550 UNTILb$>""
24560 =b$
24570 :
25000 DEF PROCkey(a$)
25010 IFa$>"" PRINT CHR$131 a$
25020 PRINT CHR$134"Press a ke
y ";
25030 a%=GET:PRINT
25040 ENDPROC
25050 :
25500 DEF FNyn(a$)
25510 PRINT'CHR$134 a$" (Y/N)"
CHR$133;
25520 REPEAT
25530 g%=GET AND 95
25540 UNTILg%=89 ORg%=78
25550 PRINT CHR$g%
25560 =g%=89
25570 :
26000 DEF PROCnum(a%,b%)
26010 PRINT CHR$134"Enter valu
e: (";a%"_";b%")"
26020 d%=VPOS
26030 REPEAT
26040 PRINT TAB(0,d%)SPC39 TAB
(0,d%);
26050 INPUT""n$
26060 UNTILn$="" OR(VALn$)=a%
AND VALn$<=b%)
26070 IFn$>""I%=VALn$
26080 ENDPROC
26090 :
26500 DEF PROCwait
26510 PRINT CHR$133"Please wai
t";
26520 ENDPROC
26530 :
27000 DEF PROCline
27010 PROCmark:A%=TRUE:PROCram
:P%=0:VDU22,135,10,10,134
27020 INPUT LINE"Text >"t$
27030 PROCram:PROCmark
27040 t$=LEFT$(t$,20):IFt$=""
t$=CHR$224
27050 ENDPROC
27060 :
27500 DEF PROCbypass
27510 IF T%<3 ENDPROC
27520 VDU22,135
27530 PRINT''CHR$134"First lin
e to skip"CHR$133"(";Q%")"
27540 I%=Q%:PROCnum(1,M%+1):Q%
=I%
27550 IF Q%>R% R%=Q%
27560 PRINT''CHR$134"Last line
 to skip"CHR$133"(";R%")"
27570 I%=R%:PROCnum(Q%,M%+1):R
%=I%
27580 ENDPROC
27590 :
28000 DEF PROCstart
28010 IF ?S%=0 PRINTCHR$13 SPC
10 CHR$133"Screen mode"SPC6':P
ROCnum(0,2):?S%=3:S%?1=22:S%?2
=I%+128:S%?3=5
28020 N%=0:C%=7:E%=0:O%=S%?2
28030 IFO%=128 m%=2 ELSE IFO%=
129 m%=4 ELSE IFO%=130 m%=16
28040 REPEAT
28050 IF S%?(N%*L%+1)=18 E%=S%
?(N%*L%+2):C%=S%?(N%*L%+3)
28060 IF N%<Q% OR N%>R% ORS%?(
N%*L%+1)=18 PROCvdu
28070 N%=N%+1
28080 UNTIL S%?(N%*L%)=0 OR N%
=T%
28090 PROCmark
28100 ENDPROC
28110 :
28200 DEF PROCvdu
28210 FOR I%=1 TO S%?(N%*L%)
28220 VDUS%?(N%*L%+I%)
28230 NEXT
28240 ENDPROC
28250 :
28300 DEF PROCmark
28310 GCOL E%+3,C%:MOVE 0,32:P
RINT;N%-1
28320 ENDPROC
28330 :
28500 DEF PROCinform:RESTORE 3
1000
28510 VDU22,135:PRINT
28520 FOR I%=0 TO 20
28530 READ a$,b$
28540 PRINT CHR$129 a$ TAB(14)
CHR$130 b$
28550 NEXT
28560 PRINT TAB(14,n% DIV 4+1)
CHR$135
28570 IF P% MOD 2=0 PRINT TAB(
14,8)CHR$135 TAB(22,8)CHR$130
TAB(14,9)CHR$135 TAB(22,9)CHR$
130 TAB(14,13)CHR$135 TAB(23,1
3)CHR$130 ELSE PRINT TAB(25,8)
CHR$135 TAB(24,9)CHR$135 TAB(2
5,13)CHR$135
28580 PRINT TAB(27,14)CHR$135;
C% MOD m% TAB(27,15)CHR$135;E%
 DIV 16 TAB(27,16)CHR$135;N%
28590 IF Q%<T% PRINT TAB(27,17
)CHR$135;Q% CHR$130"to"CHR$135
;R%
28600 PRINT TAB(25,20)CHR$135;
28610 IF P% MOD 2=0 PRINT"to f
oreground" ELSE PRINT"not back
ground"
28620 PRINT TAB(0,22)
28630 ENDPROC
28640 :
29000 DEF PROCinit
29001 *SRDATA 4
29002 *SRDATA 5
29010 M%=300:L%=34:Q%=M%+1:R%=
Q%
29020 DIM S% Q%*L%,x% 15,y% 15
29030 C%=7:E%=0:N%=0:m%=16:n%=
0
29040 VDU23,224,0,240,224,176,
24,12,6,3
29050 GOSUB 1000
29060 ENDPROC
29070 :
30000 DEF PROCerror
30010 VDU0;3
30020 IF ERR=17 ENDPROC
30030 IF ERR=6 AND ERL=3030 PR
OCkey("Invalid file"+CHR$7):CL
OSE#F%:ENDPROC
30040 IF ERR=204 PROCkey("File
name too long"+CHR$7):ENDPROC
30050 IF ERR=28 AND ERL=4550 P
ROCkey("Data entry error"+CHR$
7):ENDPROC
30060 REPORT:PRINT" at line ";
ERL:*FX 4
30070 CLOSE#0:END
30080 :
31000 DATA 1  (cursor),positio
n
31010 DATA 2  (cursor),first d
imension
31020 DATA 3  (cursor),second
dimension
31030 DATA 4  (cursor),third d
imension
31040 DATA L,line
31050 DATA T,triangle
31060 DATA P,parallelogram
31070 DATA R,rhombus  -  arc
31080 DATA S,sector  -  segmen
t
31090 DATA C,circle
31100 DATA E,ellipse
31110 DATA @,text
31120 DATA O  (toggle),outline
  -  solid
31130 DATA H,hue
31140 DATA X,ECF pattern
31150 DATA M,move to line
31160 DATA B,bypass lines
31170 DATA D,delete
31180 DATA <COPY>,fix
31190 DATA <COPY> / F,flood fi
ll
31200 DATA I,inform
31210 :
32000 DATA Clear entries,Save
file,Load file,Keyboard entry,
Draw screen,Print screen data,
Editor keys,Quit
>
```

Discovering Arthur

Philip Colmer

Compatible with Archimedes 300 and 400 series, Arthur OS 1.2.

As with all new machines (especially expandable ones), there is always a tendency to find out as much as possible about the machine – particularly if it is undocumented. The Archimedes is no exception. This article will describe and list four programs which have been written to help you discover more about Arthur. Please note that some of the programs require Arthur 1.2. If you haven't got it ring Acorn on 0223 214411 immediately! Of course, before long, we are all going to be looking at RISCOS but meanwhile...

Listing SWIs

The SoftWare Interrupt is an integral part of expanding the operating system. But how can you find out which SWIs are currently supported? Well, part of the number conversion routines includes converting a SWI number to a SWI string.

Thus, by writing a program which cycles through all of the suitable values and discards the unused SWI numbers, we are left with a list of supported SWIs. This is what the first program (ListSWIs) does. Please note that if you have loaded some relocatable modules which support SWIs, such as Clare's Toolkit, then these SWIs will be listed as well. All part of the service!

Listing file types

Another number conversion which the operating system does automatically whenever you type *EX is that of file type number to string. However, despite the fact that Acorn have allocated the 3 byte number as follows:

&E00-&FFF Reserved for Acorn use
&800-&DFF For allocation to software houses
&000-&7FF Free for the user

the operating system only knows the text for a few of these values. So how can the known text be listed? Easy! There is a filing system call, named OS FSControl, which is a multi-purpose call and one of its assignments is to convert a file type number into the appropriate string. This operation is performed by the second program (ListFTs).

Once again, if there are any modules which perform this conversion (see below), then the extra file types will be listed.

Adding file types

So far, all we have done is hacked at the system. We haven't actually made use of the expandability.

This next program (AddFTs) creates a relocateable module which the operating system will use to decode extra file type numbers into strings. This is done by using one of the service calls to a module. The module is given the file type number and if it recognises it then the appropriate string is returned in the registers and the call claimed. Currently two file types are supported – &0AB which I allocated to my pointer definer and &AF0 which is used by ArcWriter. Please note that Arthur 1.2 is required as previous verions of BASIC V do not use ALIGN and O% properly.

A mystery program

This final program (Mystery) is another demonstration of expanding the operating system – but I'm not going to tell you how it works (well, not yet anyway). The program creates an ARM code file from the DATA statements. You should then *RUN the resulting ARM code file.

The poser is this. By pressing RETURN a few times at the Supervisor prompt (*), you will see what the program does. However, the program takes no user memory whatsoever and does not claim any vectors. It makes one operating system call on start-up and then makes one call to the operating system each time you press RETURN . How does it work? Maybe if the Editor will let me, I'll tell you sometime. Please note that Arthur 1.2 is required as one of the new output routines is used (try different Modes and see what happens).

LISTING LISTING 1

```
10REM > ListSWIs
20REM
30REM Written by Philip J Colmer
40REM
50DIM block 256
60I%=0
70REPEAT
80 SYS "OS_SWINumberToString",I%,block,256
90 J%=0
100 REPEAT
110  J%+=1
120 UNTILblock?J%=0
130 block?J%=13
140 IF ($block <> "User") AND ($block <> "OS_Undefined") THEN
150  PRINT$block;
160  SYS "XOS_SWINumberFromString", 0, block TO A%
170  IF A%<&03800000 THEN PRINTTAB(40)~A% ELSE PRINT
180 ENDIF
190 I%+=1
200UNTILI% >= (1<<17)
```

LISTING LISTING 2

```
10REM > ListFTs
20REM
30REM Written by Philip J Colmer
40REM
50DIM block 9
60FOR I%=&FFF TO 0 STEP -1
70 SYS"OS_FSControl",18,,I% TO ,,p1%,p2%
80 !block=p1%
90 block!4=p2%
100 block?9=13
110 IF?block<>ASC"&" PRINT~I%;TAB(20);$block
120NEXT
```

LISTING LISTING 3

```
10REM > AddFTs
20REM
30REM Written by Philip J Colmer
40REM
50DIM code 1024
60FOR I%=4 TO 7 STEP 3
70P%=0:O%=code
80[ OPT I%
90      EQUD  0                   ; start code
100     EQUD  0                   ; initialisation code
110     EQUD  0                   ; finalisation code
120     EQUD  service             ; service call handler
130     EQUD  title               ; title string
140     EQUD  help                ; help string
150     EQUD  0                   ; help text
160;
170.service
180     CMP   R1, #&42            ; correct service call?
190     MOVNE PC, R14             ; no
200     STMFD R13!, {R4,R5}       ; stack used registers
210     ADR   R1, table
220     ADR   R5, text
230     SUB   R3, R5, R1          ; R3 = R5 - R1
240     MOV   R3, R3, ASR #2      ; divide by 4 to give # of entries
250.check
260     LDR   R4, [R1], #4        ; get next value
270     TEQ   R4, R2              ; compare file types
280     BEQ   got_it
290     ADD   R5, R5, #8          ; R5 = R5 + 8
300     SUBS  R3, R3, #1          ; R3 = R3 - 1
310     BNE   check
320     LDMFD R13!, {R4,R5}       ; restore stacked registers
330;
340.bad_exit
350     MOV   R1, #&42            ; cannot claim since not found
360     MOV   PC, R14
370;
380.got_it
390     LDMIA R5, {R2,R3}         ; load R2 & R3 with text
400     LDMFD R13!, {R4,R5}       ; restore stacked registers
410     MOV   R1, #0              ; claim call
420     MOV   PC, R14             ; and return
430;
440.table
450     EQUD  &0AB
460     EQUD  &AF0
470;
480.text
490     EQUS  "Pointer "
500     EQUS  "AW Text "
510;
520.title
530     EQUS  "Filetypes"
540     EQUB  0
550     ALIGN
560;
570.help
580     EQUS  "FT extensions"+CHR$(9)+"1.00 (31 Dec 1987)"
590     EQUB  0
600]
610NEXT
620OSCLI"Save $.Module "+STR$~(code)+" "+STR$~(O%)
630*STAMP $.Module
640*SETTYPE $.Module FFA
```

LISTING LISTING 4

```
10REM > Mystery
20REM
30REM Written by Philip J Colmer
40REM
50c%=OPENOUT("$.Advert")
60check%=0
70REPEAT
80 READ a$
90 IF a$<>"*" PROCoutput(c%,a$)
100UNTIL a$="*"
110IFcheck%<>66 PRINT"Bad checksum"
120CLOSE#c%
130*SETTYPE $.Advert FF8
140END
150:
160DEFPROCoutput(c%,a$)
170LOCAL c$,b%
180REPEAT
190 c$=LEFT$(a$,2):a$=MID$(a$,3)
200 b%=EVAL("&"+c$):check%=(check%*13+b%) AND 255
210 BPUT#c%,b%
220UNTIL a$=""
230ENDPROC
240:
250DATA "1C008FE228108FE2"
260DATA "20209FE50030A0E3"
270DATA "1040A0E3240000EF"
280DATA "0000A0E30010A0E3"
290DATA "110000EF436C6924"
300DATA "50726F6D70742063"
310DATA "000200000EF0A0E1"
320DATA "00402DE930009FE5"
330DATA "01008E22C109FE5"
340DATA "010050E10000A003"
350DATA "1C008FE524108FE2"
360DATA "001191E734008FE2"
370DATA "010080E0440002EF"
380DATA "0C008FE20120A0E3"
390DATA "00808DE8FFFFFFFF"
400DATA "060000002A4F535F"
410DATA "0000000014000000"
420DATA "740000008000000"
430DATA "10010000500100000"
440DATA "436F6E6772617475"
450DATA "6C6174696F6E7321"
460DATA "0D000000596F7520"
470DATA "6861766520 6E6F77"
480DATA "20676F7420612076"
490DATA "6572792073706563"
500DATA "69616C2070726F67"
510DATA "72616D2077726974"
520DATA "74656E2062792050"
530DATA "68696C697020436F"
540DATA "6C6D65722072756E"
550DATA "6E696E6720696E20"
560DATA "796F757220417263"
570DATA "68696D656465732E"
580DATA "0D0000004173207 4"
590DATA "6865206172746963"
600DATA "6C6573207361797 3"
610DATA "2C2074686973207 0"
620DATA "726F6772616D2069"
630DATA "732063757272656E"
```

```
640DATA "746C7920746168 69"
650DATA "6E6720616273 6F6C"
660DATA "7574656C79204E4F"
670DATA "2075736572206D65"
680DATA "6D6F72792E0D0000"
690DATA "416E642079657420"
700DATA "6974206973207275"
710DATA "6E6E696E672120 57"
720DATA "6974686F75742063"
730DATA "6C61696D696E6720"
740DATA "766563746F727321"
750DATA "20486F7720646F65"
760DATA "7320697420646F20"
770DATA "69743F0000000000"
780DATA "576879206E6F7420"
790DATA "7377697463682074"
800DATA "6F20612064696666"
810DATA "6572656E74206D6F"
820DATA "646520616E642073"
830DATA "6565207768617420"
840DATA "68617070656E7320"
850DATA "7468656E2E0D0000"
860DATA "5468697320707269"
870DATA "6772616D207769 6C"
880DATA "6C20737461792069"
890DATA "6E20746865204172"
900DATA "636B696D65646573"
910DATA "20756E74696C2070"
920DATA "6F776572206F6666"
930DATA "206F72204354524C"
940DATA "2842524541482E0D"
950DATA "00000000"
960DATA "*"
```

Colour printer driver

Philip Bowman

Compatible with

- Model B
- Master Series
- Electron

This program was written for the Star LC-10 colour printer and because the Star is Epson compatible, it should work with Epson compatible colour printers (eg the Epson JX80).

Key in the program as listed, but without the four-digit checksum number at the end of the line. Save the program, then run it. Then save the machine code by typing in the command that appears on the screen.

The colour dump command has the syntax:

***CDUMP nnn nnnnnnnn**
or
***CDUMP nnn**
or
***CDUMP**

*CDUMP can be replaced by *RUN CDUMP or */CDUMP, and either of the blocks of numbers can be replaced by X to use the default values.

The first block of numbers is made up of:

- The y-density of the printout (usually 2,4 or 8, see below for sizes)
- The graphics density (see printer manual, under ESC "*", and below)
- The logical colour 0 ink colour (see next paragraph)

The second block of numbers is the list of logical ink colours. Each logical colour on the computer has an equivalent in the program. These may not always be appropriate, for example many colour dumps can result in a purple, rather than a blue sea, so the logical colours can be changed. The default colours are:

No.	Computer	Printer	cdump data block no.
0	black	white	0
1	red	orange	5
2	green	green	6
3	yellow	yellow	4
4	blue	violet	3
5	magenta	red	1
6	cyan	blue	2
7	white	black	8

Therefore the default colour block is 05643-128. Changes made to the palette by VDU 19 are taken into account automatically by the program.

The last digit of the first data block sets the logical ink colours for black and white only, so if you want a black background instead of a white one, for a more accurate printout, this digit should be 8. If you are setting the second data block manually, this digit is unimportant.

The routine is loaded in from disc or tape each time it is run, so tape users may prefer to have it at the start of a tape. For tape users the code can locate itself in pages nine, ten and eleven, so it overwrites the function key definitions. The location can be changed by changing M% at the beginning of the program (to &900). Currently it locates itself from &1500 to &1780 which is suitable for disc users.

Since the program uses the machine code equivalent of POINT, it is slower than some other colour dumps, but will work in any graphics Mode (not 3, 6 or 7), and with shadow RAM activated.

Dumps can be printed onto single sheets or fanfold paper, but dip switch 1-8 must be OFF on Star LC-10 printers (this is the normal position for printing with the BBC). For users of other printers, the equivalent DIP switch, which controls auto line feeds, should be switched on.

The different densities give the following sizes (the graphics density may be different for other printers:

y-density (length in cm)	Graphics density (width in cm)
2 (17.0)	1 (13.6)
4 (8.8)	2 (13.6)
8 (4.5)	3 (6.8)
	4 (20.2)
	6 (18.0)

830 gives a good small printout. Experiment to find other values that work well together. If a black bar appears at the bottom of the picture, and this is particularly unwanted, add the following lines to the program (although this may slow down the program somewhat):

```
1491 LDA&76
1492 CMP#255:BNE valid
1493 LDA#0:STA&74
1494 .valid 1495
```

Philip is a student with programming as a hobby. Submissions of dump routines for all types of printer are welcomed.

LISTING LISTING

```
   10REM Machine code screen d
ump for LC10 P. Bowman (c>asp
1989
   20FORO=0 TO 2 STEP 2
   30M%=&1500
   40P%=M%
   50[OPT O
   60PHP:PHA:TYA:PHA:TXA:PHA
   70
   80LDA#135:JSR&FFF4:TYA:AND#
7:CMP#7
   90BNE over1
  100
  110PLA:TAX:PLA:TAY:PLA:PLP
  120
  130BRK
  140OPT FNequb(&80)
  150OPT FNequs("In mode 7")
  160BRK
  170
  180.over1
  190LDA#1:LDY#0:LDX#&7C
  200JSR&FFDA
  210
  220LDY#0:LDA(&7C),Y:CMP#13:B
NE testx1
  230JSR def1:JSR def2:JMP ove
r3
  240
  250.testx1
  260LDY#0
  270CMP#88:BNE args1
  280JSR def1:JMP over2
  290
  300.args1
  310LDA (&7C),Y:JSR check:STA
&79
  320INY:LDA (&7C),Y:JSR check
:CMP#7:BCS error:STA&78
  330INY:LDA (&7C),Y:JSR check
:STA&80
  340
  350SEC:LDA#8:SBC(&7C),Y:STA&
87
  360
  370LDA#&FF:STA&70
  380JMP over2
  390
  400.check:SEC:SBC#48:BMI err
or
  410CMP#9:BCS error:RTS
  420
  430.error
  440PLA:TAX:PLA:TAY:PLA:PLP
  450BRK
  460OPT FNequb(&81)
  470OPT FNequs("Syntax: *CDUM
P (nnn/X (nnnnnnnn/X))")
  480BRK
  490
  500.def1
  510LDA#4:STA&79
  520LDA#2:STA&78
  530LDA#0:STA&80
  540LDA#8:STA&87
  550LDA#0:STA&70
  560RTS
  570
  580.def2
  590LDA#5:STA&81:LDA#2:STA&86

  600LDA#6:STA&82:LDA#4:STA&83

  610LDA#3:STA&84:LDA#1:STA&85

  620LDA&70:CMP#&FF:BEQ defend

  630LDA#8:STA&87:LDA#0:STA&80

  640.defend
  650RTS
  660
  670.over2
  680INY
  690LDA(&7C),Y:CMP#13:BNE tes
tx2
  700JSR def2:JMP over3
  710.testx2
  720INY
  730LDA(&7C),Y:CMP#88:BNE arg
s2
  740JSR def2:JMP over3
  750
```

```
  760.args2
  770LDX#0
  780.store
  790LDA(&7C),Y:JSR check:STA&
80,X
  800INX:INY:CPX#8:BNE store
  810
  820.over3
  830LDA#0:STA&7B
  840.map
  850LDA#&B:LDX#&7B:LDY#0
  860JSR&FFF1
  870LDX&7C:LDA&80,X
  880LDX&7B:STA&88,X
  890LDX#&60:LDA#&A0:JSR&FFF4
  900STX&71
  910LDA&7B:CMP&71
  920BEQ setup
  930CMP#8:BEQ setup
  940INC &7B
  950JMP map
  960.setup
  970
  980LDA#2:JSR&FFEE
 1000LDA#64:JSR escape
 1040LDA#6:LDX#0:JSR&FFF4
 1050
 1060LDA&79:ASL A:ASL A:ASL A
 1070STA&7C
 1080
 1090LDA#3:STA&76
 1100LDA#255:SEC:SBC&7C:STA&75

 1110.loopy
 1120
 1121LDA#65:JSR escape
 1122LDA#0:JSR print
 1130LDA#0:STA&7A
 1140.loopr
 1150
 1160LDX&7A:LDA ink,X:STA&7D
 1170JMP over4
 1180.ink
 1190OPT FNequd(&00040201)
 1200
 1201.escape
 1202PHA:LDA#27:JSR print
 1203PLA
 1210.print
 1220PHA:LDA#1:JSR&FFEE:PLA:JS
R&FFEE
 1230RTS
 1240
 1250.over4
 1270LDA#114:JSR escape
 1280LDA&7D:JSR print
 1290
 1310LDA#42:JSR escape
 1320LDA&78:JSR print
 1330LDA#128:JSR print
 1340LDA#2:JSR print
 1350
 1360LDA#0:STA&70:STA&71
 1370.loopx
 1380
 1390LDA#0:STA&7B
 1400
 1410LDA#0:STA&7F
 1420LDA#1:STA&77
 1430.loopz
 1440
 1450CLC:LDA&75:ADC&77:STA&72
 1460LDA&76:ADC#0:STA&73
 1470LDA#9:LDX#&70:LDY#0
 1480JSR&FFF1
 1490
 1500LDX&7A:JSR raise
 1510STA&7E
 1520LDX&74
 1530AND&88,X
 1540CMP&7E
 1550BNE over5
 1560LDX&7F:JSR raise
```

```
 1570CLC:ADC&7B:STA&7B
 1580
 1590.over5
 1600INC&7F
 1610CLC:LDA&77:ADC&79:STA&77
 1620LDA&7F:CMP#8:BNE loopz
 1630
 1640LDA&7B:JSR print
 1650
 1660CLC:LDA&70:ADC#2:STA&70
 1670LDA&71:ADC#0:STA&71
 1680CMP#5:BNE loopx
 1690
 1700LDA#13:JSR print
 1710
 1720INC&7A:LDA&7A:CMP#4
 1730BEQ newline
 1740JMP loopr
 1750
 1760.raise
 1770LDA power,X
 1780RTS
 1790.power
 18000PT FNequd(&08040201)
 18100PT FNequd(&80402010)
 1820
 1830.newline
 1831LDA#65:JSR escape
 1832LDA#8:JSR print
 1840LDA#13:JSR print
 1860
 1870SEC
 1880LDA&76:CMP#255:BEQ reset
 1890LDA&75:SBC&7C:STA&75
 1900LDA&76:SBC#0:STA&76
 1910JMP loopy
 1920
 1930.reset
 1940LDA#3:JSR&FFEE
 1960PLA:TAX:PLA:TAY:PLA:PLP
 1970RTS
 1980]
 1990NEXT
 2000PRINT" Type : *S. CDUMP "
;~M%;" + ";~(P%-M%+(16-(P%-M%)
MOD 16)
 2010END
 2020DEF FNequb(A%)
 2030?P%=A%
 2040P%=P%+1
 2050=0
 2060DEF FNequd(A%)
 2070!P%=A%
 2080P%=P%+4
 2090=0
 2100DEF FNequs(A$)
 2110$P%=A$
 2120P%=P%+LEN(A$)
 2130=0
 2140
```

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BACK PAGE COMPUTING

Recently, the captains of the computer industry have been writing their memoirs. These adrenalin-soaked dramas of corporate warfare chronicle the everyday boardroom showdowns, vendettas and crazed bids for power that are essential for the smooth running of any computer company.

But there is still one story left to be told. A top executive at one of the leading micro-making corporations has given his diaries to Abacus. We cannot reveal which company so the names of all the participants (except animals) in the following extracts have been changed to Roman emperors.

Dear Diary,
Got to the office at the usual time and was surprised to find Caligula, our managing director, leaving a poison-pen memo on my Psion Organiser. "Hellow Claudius", he said in that way of his which always made me feel like a squashed insect. "Morning Mr Caligula", I stuttered cheerily, trying to make out as if nothing had happened. He turned to leave, then stopped, went over to my PC and tipped it out of the window. He looked at me and said, "This is business. Don't take it personally". I raked him with my machine gun laugh. "Oh, by the way," he continued, "do you fancy a game of squash at lunch time?" Many people would have thought this was a friendly gesture but I knew Caligula played for keeps, or, if he was in a good mood, the best of three coronaries.

Dear Diary,
Reached work at the usual time and saw lots of horseboxes in the car park. 'Must be a board meeting', I thought. A few eyebrows had been raised when Caligula insisted there should be a horse on the board. But, after a little argument, it was agreed that a token horse might be just the sort of PR the company needed. It turned out to be the thin end of the wedge and now Dobbin and his cronies were a force to be reckoned with. Only yesterday a memo about all staff being required to wear nosebags had landed in my in-tray. Even so, Caligula has the whip hand. In private many have said they think Caligula is a little eccentric. Of course Caligula's not his real name – he just insists that all staff call him that. He's a slick operator and even under extreme pressure he's as cool as a cucumber – he even carries one around for instant comparisons.

Dear Diary,
They are taking Northern Europe away from me. They are giving it to Nero, of all people. I doubled computer sales in six months and they give my job to a fat slob who can't even get into a designer toga. And what do they give me? The Balkans. I stormed into Caligula's office and threw my resignation on the desk. "Aren't you forgetting something?" asked Caligula. He was right. In my rage it had quite slipped my mind that Caligula had kidnapped my wife and children a few weeks ago. I snatched my resignation back, thanked him for the Balkans and left.

Dear Diary,
Arrived at work around the usual time to find the building under siege from hordes of fraud squad officers. I fought my way through into the offices. It was chaos. Staff were shredding every file in sight. I came across Dobbin, who was leaning against a filing cabinet, crying. "What happened?" I enquired. Dobbin began to rap slowly on the floor with his hoof in morse code "It's all over," he tapped, "I've been put out to pasture." I was running through the offices when I saw Hadrian, he was drinking heavily and staring blankly at his wall. "Why are the police here?" I asked. "Someone's been fiddling the books", slurred Hadrian. "It sounds like Nero," I said, and sure enough, down the corridor, Nero was plucking his ukelele while piles of computer print-outs burned all around him. At that moment Caligula, carrying a sub-machine gun, burst into the room and announced that all was not lost. He was creating a holding company and we were to be employed as hostages on short term contracts. Amid our cheers, Caligula guided us at gunpoint to the basement where I had an emotional reunion with my wife and kids. As the police appealed through loud hailers to Caligula to give himself up, he shouted back that he'd only negotiate with a policehorse, I couldn't help wondering whether being a computer executive was really the right job for me. Maybe I should have listened to my godfather. I could have been running the family business by now.

Back Page Xmas Special

Christmas time has hit us good and proper at Back Page HQ.

To celebrate we've put together a cut out and keep Driftwood Publications Employee as mentioned in our column in Novembers magazine for squirrels.

Just cut out the figure, stick him on to thin card (get a grown up to help you with that bit) and then you can have endless fun over the Christmas hols clothing Commander Tony Jameson-Bell in his outdoor leisure outfit, his Press Launch/Sunday Best and of course his interstellar Super Hero costume (gasp).

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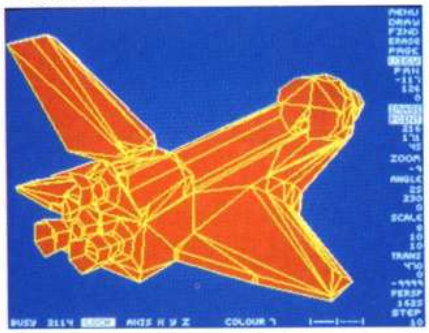

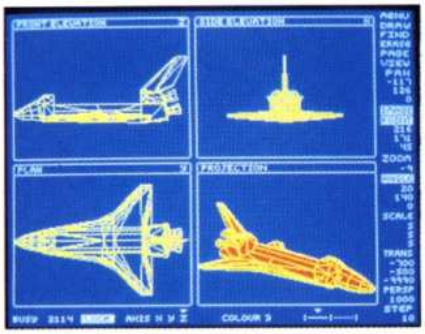

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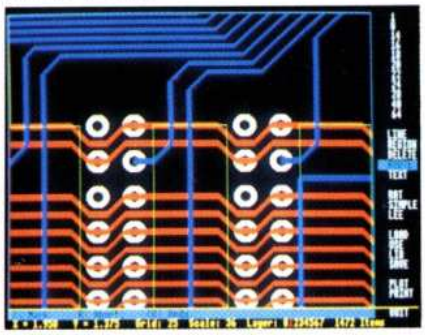

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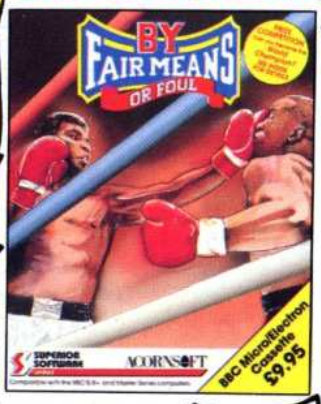

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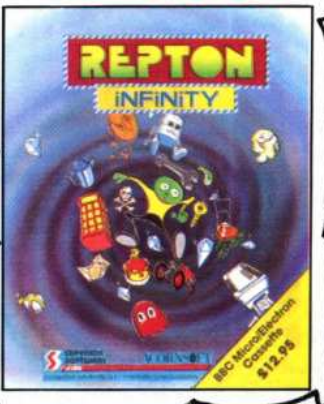

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